Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 66 NEW YORK, SATURDAY, AUGUST 21, 1915 No. 8

Welcoming the Public

THE central station has so few opportunities to get in touch with the public that it should take full advantage of all that it can make. The old practice of hiding the light under a bushel is no longer standard, and companies that cling to it do so at inevitable loss. In the properties whose management best represents the highest type of good policy a public understanding of methods and policies is welcomed. A frank and cordial attitude serves the twofold purpose of developing friendship and advertising service. An illustration of an opportunity seized is found in the announcement of reduced rates by the Sioux City (Iowa) Gas & Electric Company, which includes an invitation to inspect the plant as soon as improvements are completed. The question is not whether anyone will take the trouble to go; the point is that people shall feel and remember that they have been asked, that inspection is encouraged.

When Competition Is Wasteful

THE injustice of those public service commission laws which apply rigidly to private plants and bear easily on municipal plants is revealed clearly in a recent Missouri decision. In dismissing the complaint by the Missouri Public Utilities Company that the city of Poplar Bluff should be required to have a certificate of convenience and necessity before installing a competitive plant the commission shows that the law leaves it no alternative course. The commission expresses no opinion as to the fairness of this action or as to the economic wisdom of permitting duplication of capital investment, but says that after the establishment of a municipal plant it has ample authority to regulate rates and service. Liberty of action was reserved for municipalities in the Missouri and some other regulative laws as a concession to advocates of strict "home rule." Evidently the free right to establish competitive plants was intended for use as a club to force rates and service conditions upon the private utility. As a big stick this may be effective sometimes, but it is completely out of harmony with the plain economic tendency to make monopolies of public utilities and then to subject them to firm regulation. Since the monopolistic character of these enterprises is justifiable, competition from a municipality is unjustifiable. If a company gives unsatisfactory service or discriminatory or unduly high rates, the proper remedy in both law and public policy lies with the State commission. But, ignoring these considerations, the waste of capital in Europe carries a lesson against the waste of capital in competitive, duplicate plants, whose ultimate cost the public must meet.

"It" or "Her"?

SHIPS are about to be built like bridges, starting from design sheets and blueprints. Numbered sections and parts will be fabricated by order in one place and assembled in another. The result will be a vessel for carrying cargoes. The question in the engineer's mind is, "Will the structure be a *ship?*" When the ship slid down the ways in the yards he has known from his youth, everyone shouted, "There *she* goes!" He wonders whether under the new régime the onlookers will say, "There *it* goes!" He thinks that the spirit of work which personifies and individualizes the task is reflected in the quality of the finished product; and when men do not see the ship grow from start to finish he wonders whether as workmen they will do as well. Standardization is a necessary factor in modern industry. In no other industry has it been developed more successfully than in the electrical field. But if the creative spirit which has given the industry its tremendous impetus is to continue, must we not find ways of discussing "her" instead of "it"?

Changing the Buyer's Habits

WIVES and mothers, to say nothing of maids-of-all-work, have cooked for years with an open flame. All the technique of the kitchen has been developed with heat that can be seen. Here is a problem in widening the application of electrical cooking appliances that must be recognized and dealt with. The habits of a buyer cannot be changed over night. Appearance, convenience, simplicity, durability, economy—all these are attributes of cooking by electricity. But the average woman is the unit in the market, and if the market is to be developed, it is at least as important to study her requirements as it is to increase the electrical efficiency of the device or appliance. Let us have a conference of women users. Let us see how electric appliances can be adopted by centers of influence, like domestic-science schools, in high-school departments and colleges. Let us find ways to change the habits of a nation.

Electricity for Exhibits

THE plan of the Society for Electrical Development to lead manufacturing exhibitors at agricultural shows to equip machinery for electric drive suggests that other latent markets await cultivation. The Pacific Gas & Electric Company has published a list showing the extent of the use of electricity and gas at the San Francisco Exposition. Much work has been di-

rected toward outlets of this character, sometimes with excellent results, occasionally without tangible impression. The advantages of electricity for local agricultural displays as well as for expositions of international importance have been discussed so often that there is danger that they will be considered as thoroughly understood. This attitude is fatal. To encourage electrical applications at temporary exhibits is like soliciting a trial order. If it is liked, real orders will follow. This can be done with articles well adapted for exhibition and of practical merit such as electrical manufacturers offer. Many unsupplied markets are promising, and every potential source of business is worth testing with full appreciation of the fact that only time and diligence will bring substantial financial results. To the electrical manufacturer an effort that fails to yield an immediate order when the desire for final profitable business is evident is merely an effort to be repeated.

The Use of the Eyes

Tradition goes that great men of all nations have become great because of night vigils by the pine-knot flame. Every one who reads the lives of men of achievement must be impressed with the fact that few people used their eyes after darkness in the pioneer days. Whether the present wide use of the eyes after dark has tended to make more great men might be questioned, but at least this is true, that under modern conditions the average person uses his eyes much more after nightfall. Artificial light has extended the day. A committee on the prevention of blindness from the New York Association for the Blind is taking active steps to promote the more intelligent use of light. Every effort to this end should be encouraged, and the present publication of the committee, like an earlier one of the Illuminating Engineering Society, would serve to direct useful attention to the care of the eyes when working by artificial light. There is no doubt that eye strain and its unpleasant results have been on the increase since the introduction of powerful gas and electric lights, but we have grave doubt whether either the quality of these illuminants or the improper manner of their use has been as important a factor in the result as the mere added use of the eyes which has come with modern improvements in lighting. Man has become to a very considerable extent a nocturnal animal. Instead of using his eyes for ten or twelve hours a day, he is likely to use them for sixteen or eighteen, not always under the best conditions either by day or night. In short, he is calling upon his eyes for 50 per cent more hard work than his grandfather did, and if he has correspondingly more trouble, one need not wonder. In other words, extensive use as well as improper use plays an important part in the result.

If one's eyes are afflicted with even slight errors of refraction, the strain is increased by the added hours of service, and the eye may fail long before trouble would have developed with more moderate use. More eye strain comes from imperfect eyes than from imperfect lighting, and in use the imperfect eye generally goes unnoted, masked by the easy accommodation of youth. Closer attention to the eyes of children and prompt action where defects are discovered would obviate, on the part of the middle-aged, many complaints of improper lighting. We do not in the least wish to discourage efforts at the better use of artificial light. On the contrary, we are most heartily interested in them, but merely suggest the collateral investigation of this other matter, since bad lighting and bad eyes cooperate to the same evil end.

Storage Batteries in Alternating-Current Systems

In the early days of electric lighting with direct-current generators the storage battery became recognized as a valuable adjunct to a lighting system, enabling the system to be operated for a time during any temporary interruption of the generator plant. It was also soon discovered that such a storage battery, connected to the mains of the system, served to regulate the system's voltage automatically. The floating storage battery finally became a well-known auxiliary plant in a direct-current distribution system. Nevertheless, in the early days of storage-battery development the storage cells were apt to give much trouble. Between sulphating, short-circuiting and general depreciation, the central-station operators had much difficulty in maintaining their cells in working order.

As the alternating-current system, through its capabilities for utilizing high voltages, came into increasing favor, it was found desirable to retain the use of storage batteries by transforming the alternating-current into direct-current power at distributing substations and connecting the batteries across the direct-current mains. Although this method of using storage batteries in connection with alternating-current generating systems has come into extensive use, yet the need has been felt of securing the benefits pertaining to floating-battery operation on simple alternating-current systems, without complete conversion to direct currents. In such systems use is made of a motor-generator, running synchronously on the alternating-current side, connected to the three-phase distribution system. The direct-current side is connected with the storage battery in such a manner that, depending on the excitation, the battery will be either charged or discharged. Series transformers in the alternating-current mains are so connected with the direct-current machine that when the alternating-current load exceeds a predetermined limit the excitation is such as will allow the battery to discharge and deliver energy from the machine to the mains; whereas, when the alternating-current load falls below the limit, the battery discharge may either cease or the battery may receive energy from the mains.

The essential difference between such systems and the ordinary alternating-current-generator direct-current-distribution system is that in the latter all the energy is converted into direct-current energy for distribution through the mains, whereas in the former only the

energy which must enter or leave the floating battery is so converted. If the energy which may be so drawn from the batteries is a large fraction of the total energy delivered, it may be more desirable to convert all the energy and keep the battery on the direct-current mains, whereas if only a small amount is needed the motor-generator battery link may be preferable.

Sidelights on Auxiliary Motor Service

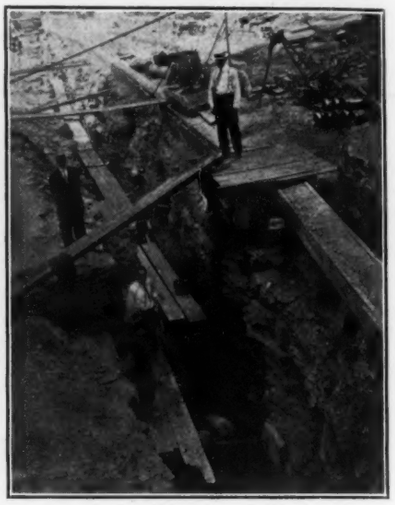
A close study of industrial conditions in the territory served by a central station will nearly always bring to light many interesting points, some of which may at times be of use in the solicitation of new business. In connection with the supply of auxiliary motor service, for example, in a city where a large number of mills use water-power during the daytime, an excellent opportunity arises for the introduction of central-station service at night. It frequently happens in these establishments that one or more departments are operated after 6 o'clock at night, and if the supply of water-power is curtailed or shut off at this time, the cost of serving one or two departments may run up into prohibitive figures. Even where the mills operate steam-turbine plants of their own, such plants very often contain such relatively large units that they cannot be operated economically on small loads. Such stations may contain small sets suitable for mill lighting, but not infrequently the main generators are also too large for satisfactory operation on fractional night loads. In such a case the central station can render an economical service to the mill owner and at the same time improve its own station load-factor. There are plenty of cases where an auxiliary motor service of this kind may act as the entering wedge for still more load later on. This class of business is not to be despised by central stations in large manufacturing centers, nor should mill owners hesitate to consider the service when they can use it on account of old-time prejudice or fear of obligation.

Newspaper Publicity at Electrical Conventions

Much good may be accomplished by helping the local newspapers to publish an intelligent popular account of electrical conventions occurring "in their midst." The geographic sections of the N. E. L. A., and some of the State associations, too, are getting much more newspaper space nowadays than formerly, and it all helps to drive home the meaning of electricity for the average citizen. The more times the very word "electricity" appears in print in the daily press the better. Hence a willingness to help the local reporter prepare a first-class "story" reaps its own reward in most instances. To do this properly, some prominent member of the organization should be prepared to tell the local press the "high spots" of the papers, and perhaps a word or two about discussions by noted delegates, with appreciative biographical comments relative to the leaders in attendance, their interests and associations with the great work of the industry. The public, after all, is more interested in the personal side of the prominent men who attend a convention, and often it is possible to arrange for interviewing one or two of these gentlemen for local newspaper uses upon some topic of general interest, with a photograph of the speaker and a brief note as to why he is so highly regarded within the electrical field. Illustrations of electrical decorations, of displays of apparatus at the meeting place, and short but newsy advance notices of the gathering, all play their part in maintaining popular interest, and the practice of inviting prominent business men and of opening the doors of most of the meetings to the local public cannot be too highly commended.

Steam Precedents and New Conditions

Precedent, like a rut in a road, is one of the easiest things to follow and one of the most difficult to get away from, and it is probable that the setting of steam boilers with respect to their furnaces was until a comparatively recent time largely a matter of precedent. On this basis it is possible to account for the low evaporative performances of some boilers and the smoke-producing tendencies of others. Although the furnace and the boiler are combined in one unit, it must be remembered that each has its own function. The sole purpose of the furnace is to change the energy in the coal to heat energy in a sensible form, and the object of the boiler is to absorb the heat thus liberated. The efficiency of the whole apparatus is the product of the efficiency of the furnace and that of the boiler proper, and hence a low over-all efficiency may be due to the poor performance of the heat-generating part or of the heat-absorbing part, or to both. In any case the furnace should be so arranged with respect to the heating surfaces that combustion will be completed before the boiler begins to absorb heat from the products of combustion. The absorption of heat from the gases may be carried to any practicable limit without altering the nature of the gases, but if the absorption of heat is begun before the combustible gases are fully oxidized the resulting chilling will stop combustion and there will be loss of heat through the escape of unburned gases, depositing of soot on the heating surfaces, and lowered efficiency. The latter conditions are frequently traceable to an incorrect relation of boiler and furnace, so that one interferes with the other. With a false idea of economy the distance between the grate and the nearest heating surface may have been cut down to effect a saving in the cost of brickwork, thus reducing the height of the furnace and combustion chamber; or the setting may have been properly designed and constructed for the use of coal containing little volatile matter, and the fuel may have been changed later without a thought as to the suitability of the arrangement for a long-flaming coal. Numerous cases of low efficiency, together with persistent smoke trouble, have been overcome by the simple expedient of increasing the height of the furnace. This would indicate the necessity for a more accurate knowledge of the behavior of fuels in boiler furnaces.



A RISE of land in the heart of Pittsburgh dammed the flow of trade across the city. Sewers, water pipes, cable ducts and conduits of all classes had to be lowered when this "hump" was cut down. The relocation of wires and cables for thirteen service companies in all the confusion of blasting, digging and hauling was accomplished with practically no interruption of service. The work done by the Pittsburgh & Allegheny Telephone Company, of which Louis Muhlheizler is chief engineer and Frank M. Weaver engineer of cables and subways, is typical of the way the problem was met. The photographs above indicate the task and something of the method of accomplishment. As the cutting of the "hump" proceeded and the street was brought down to the level of the conduits, it was found that the drilling and blasting in the immediate vicinity shattered the vitrified-clay conduits, putting them in such condition that further excavating would cause the conduit line to collapse. The clay conduits were then broken off the cables as shown in Fig. 2, and the cables were planked up in a box of 2-in. planks, as shown in the right of Fig. 3. Alongside the plank box is the trench, 22 ft. deep, in which a conduit

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

St. Louis Rates to Be Reduced as Customers Increase

The Union Electric Light & Power Company of St. Louis has announced reductions in rates effective with meter readings from Sept. 15, and promises further decreases as the number of customers increases. To offer an inducement to residence customers to avail themselves of the comfort and convenience of a more liberal use of electrical energy in homes, a third step in the residence schedule is announced—3 cents per kilowatt-hour for all use in excess of 7 kw.-hr. per month per active room. Changes are also made in rates for commercial lighting and motor-service energy and exclusive motor service.

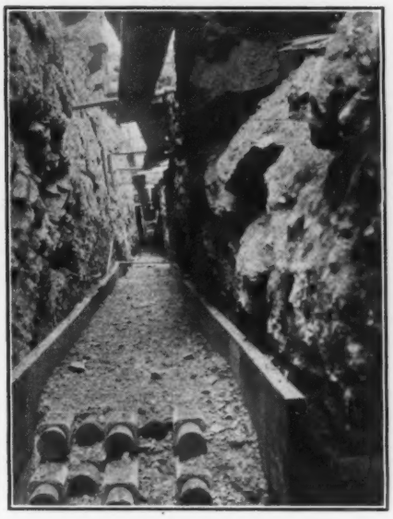
The further reductions offered as the total customers increase are set forth in detail by the company. The total number of residences in St. Louis is approximately 120,000, of which at present 33 1/3 per cent, or in round figures 40,000, use company service. In addition, the company has over 20,000 commercial and motor-service customers. The number of customers beginning with Jan. 1, 1910, when there were 23,750, has increased as follows: Jan. 1, 1911, 28,250 customers; Jan. 1, 1912, 33,750 customers; Jan. 1, 1913, 38,000 customers; Jan. 1, 1914, 46,300 customers; Jan. 1, 1915, 54,500 customers; Aug. 1, 1915, 60,700 customers. It is reasonable to expect that in December, 1915, 65,000 customers will be reached. Continued rapid growth will enable the company to make further reductions in rates from time to time and thus share its prosperity with an increasing number of patrons. As the number of customers increases the company therefore offers the following further reductions in the primary rate: When the total number reaches 65,000, a reduction to 9 cents per kilowatt-hour; when the total reaches 70,000, 8.5 cents per kilowatt-hour; when the total reaches 75,000, 8 cents per kilowatt-hour. Proportionate rate reductions in the secondary and other steps of the schedule will be put into force.

The company believes that the 75,000 mark should be reached within the coming year. In the notice to the public it says that it is difficult to forecast too far ahead with any degree of certainty, bearing in mind the rapid advance in the art and improvements and efficiencies which are being developed constantly, to what extent even further reductions may prevail. Large additional capital investment is required continuously to maintain a public utility which must keep abreast of the times to render the best of service at the lowest possible rates.

Cleveland Municipal Plant Developments

It is stated in Cleveland that the municipal electric plant will charge $50 per year for the 1000-cp. lamps and $60 for the 1500-cp. lamps to be used in the new lighting system which is to be installed in the business section. The Cleveland Electric Illuminating Company, which has been receiving $49.80 per year for arc lamps of about 1200 cp. used on the streets, was not permitted to bid on the new installation. The increased price is attributed to higher maintenance cost of the new lamps.

The report made to Mayor Baker by Commissioner of Light and Heat Ballard for the first half of the year shows that the municipal plant now has 13,423 consumers. The South Brooklyn and Collinwood plants had



line was to be constructed embodying the "split-duct feature" of conduit construction. These special conduits are scored lengthwise inside and outside before being vitrified or baked and can be easily broken in two. A layer of half ducts is first laid in cement. It is then possible to place the cables in the ducts and replace the caps or top halves of the ducts.

The cables thus lowered below the new grade of the "hump" contained 3481 miles of No. 20 and No. 22 B. & S. copper wire, paper-insulated, twisted into pairs and inclosed in lead sheaths. The time required to accomplish the work was eighteen months, and the cost to the telephone company in the neighborhood of $75,000.

The photographs are presented in order across these two pages. Fig. 1 indicates the character of the cutting. Figs. 2, 3 and 4 have already been referred to. Fig. 5 shows cables systematically arranged and hung in trench, and Fig. 6 something of the detail problems involved in the transfer. Eight hundred wires had to be cut, one at a time, in order to get a cable around an obstruction. It is estimated that the method of relaying the old cables in split ducts instead of buying new cables saved $40,000.

6417 customers before the new plant was put into operation. The report showed receipts of $302,898 and disbursements of $245,254.

Mayor Baker is opposed to the suggested resignation of Mr. Ballard as commissioner, notwithstanding the fact that he is consulting engineer for two other cities. Mayor Baker said that city-wide 3-cent energy has not yet been won. Several members of the Council are opposed to the plan to have Mr. Ballard hold the position unless he gives it his entire attention.

The Civil Service Commission has ruled that city electricians under civil service who strike will be consdered as having resigned and their places will be filled by others. The union asked for an increase in wages for these men from $5 to $5.50 per day to meet the new scale adopted recently, but the city refused to make any change.

A. I. E. E. Committee Appointments

The board of directors of the American Institute of Electrical Engineers held in New York on Aug. 10 its first meeting of the administrative year which began on Aug. 1.

President John J. Carty announced his appointments on the various Institute committees for the administrative year. The chairmen of the committees appointed are as follows: Finance, Mr. J. Franklin Stevens, Philadelphia, Pa.; library, Dr. Samuel Sheldon, Brooklyn, N. Y.; meetings and papers, Mr. L. T. Robinson, Schenectady, N. Y.; editing, Prof. H. H. Norris, New York; board of examiners, Dr. A. S. McAllister, New York; sections, Mr. H. A. Hornor, Philadelphia, Pa.; standards, Prof. C. A. Adams, Cambridge, Mass.; code, Mr. Farley Osgood, Newark, N. J.; law, Mr. G. H. Stockbridge, New York; power stations, Mr. C. F. Uebelacker, New York; transmission, Mr. P. H. Thomas, New York; railway, Prof. D. C. Jackson, Boston, Mass.; protective apparatus, Dr. E. E. F. Creighton, Schenectady, N. Y.; electric lighting, Dr. Clayton H. Sharp, New York; telegraphy and telephony, Mr. G. M. Yorke, New York; industrial power, Mr. David B. Rushmore, Schenectady, N. Y.; use of electricity in marine work, Mr. C. S. McDowell, New York; electrochemics, Prof. A. F. Ganz, Hoboken, N. J.; electrophysics, Mr. John B. Whitehead, Baltimore, Md.; records and appraisals of properties, Mr. Philander Betts, Newark, N. J.; educational, Prof. V. Karapetoff, Ithaca, N. Y.; public-policy committee, Mr. Calvert Townley, New York; development of water-powers, Mr. Calvert Townley, New York; patents, Mr. Ralph D. Mershon, New York; membership, Mr. W. A. Hall, Lynn, Mass.; historical museum, Mr. T. C. Martin, New York; United States national committee, International Electrotechnical Commission, Mr. C. O. Mailloux, New York; relations of consulting engineers, Dr. L. B. Stillwell, New York; code of principles of professional conduct, Prof. George F. Sever, New York; hazards from lightning, Prof. Elihu Thomson, Swampscott, Mass.; reserve corps of engineers, Mr. Bion J. Arnold, Chicago, Ill.; constitutional revision, Mr. Bancroft Gherardi, New York. Representatives were also appointed on various joint committees and other bodies.

The board also confirmed the appointment by the president of the following members of the Edison Medal committee for terms of five years each: Mr. Carl Hering, Prof. Harris J. Ryan and Mr. H. G. Stott.

The board elected from its own membership the following members to serve upon the Edison Medal committee for the term of two years, to fill the places of members whose terms had expired: Messrs. B. A. Behrend, Paul M. Lincoln and William McClellan. Mr. Farley Osgood was elected for the term of one year, to fill a vacancy on the committee.

The secretary reported that since the last meeting of the board the executive committee had unanimously voted to increase the Institute's guarantee toward the expenses of the International Engineering Congress

from $3,500 to $5,000, thereby placing the Institute upon the same financial basis in relation to the congress as the American Society of Mechanical Engineers and the American Institute of Mining Engineers. The Institute's limited participation in the congress had been due to the fact that at the time the original action was taken in June, 1912, the Institute had guaranteed the entire expenses of the International Electrical Congress, which has since been indefinitely postponed. The resignation of Mr. A. M. Hunt as one of the Institute's representatives upon the committee of management of the International Engineering Congress, due to his removal to the East, was accepted with regret, and a resolution expressing appreciation of his valuable services to the Institute while on the committee was adopted.

The increase from limited to full participation in the congress entitles the Institute to the full complement of representatives upon the San Francisco committee of management—that is, an increase from two to four representatives—which, with the resignation of Mr. Hunt, made necessary three additional appointments. President Carty appointed Messrs. Harris J. Ryan, A. H. Babcock and H. A. Lardner. These appointees, together with Mr. J. T. Whittlesey, previously appointed, complete the Institute's representation.

Forty-eight applicants were elected to grade of associate, and twelve students were ordered enrolled. Five applicants were elected and nineteen transferred to grade of member. Prof. Michael I. Pupin, New York; Mr. James W. McCroskey, New York; Mr. Ray Palmer, Chicago, Ill., and Mr. Halfdan A. Steen, Franklin, N. J., were transferred to grade of fellow.

An invitation was presented from the American Institute of Mining Engineers to appoint delegates to represent the A. I. E. E. at the San Francisco meeting of the A. I. M. E. in September, and the president was authorized to appoint such delegates.

ELECTRICAL INDUSTRY AND THE WAR

Various Side Lights on Its Effects on the American Market Contributed by Prominent Central-Station Officials

In order to ascertain just how the present trouble in Europe has affected the American electrical industry in various sections of the country, the ELECTRICAL WORLD addressed a number of prominent central-station officials, manufacturers, jobbers and contractors, requesting their opinions and observations based on their experiences after a year of the war.

The central-station industry, while it has gone forward, did not enjoy during the past year the same ratio of increase owing to a combination of depressed business conditions and to the war. Capital for development purposes is not now easy to obtain despite the permanency of the investment and the vast amount of gold hoarded in bank vaults.

Throughout the trade many of the manufacturers feel the results of decreased building operation, but yet they are sanguine of good times to come. The contractors and jobbers naturally experienced some setback in business because of stagnant building trade conditions, while, on the other hand, the widening application of electricity and the campaign for the intensive cultivation of customers now being waged by many central-station companies has resulted in increased sales of electrical appliances, so that dealers generally look on present conditions with complacency.

Appended herewith are communications received from the heads of some of the largest holding companies in the country bearing on the situation:

New Developments and Extensions Retarded

"The earning power of the electrical industry, taken as a whole, has been hurt but little by war conditions. However, the uncertainties created by war conditions have somewhat depressed the market value of electrical securities along with all securities generally, other than the so-called 'war stocks.' Naturally these difficulties have adversely affected the ease of permanently financing every line of business.

"The money markets and the investment or capital markets, now as always in times of disturbance, have drifted far apart. Money, as exemplified by short-time, well-secured loans, is dirt cheap and is going begging, whereas capital for permanent investment, particularly for new enterprises, is almost unobtainable at any reasonable price. This has naturally had the effect of checking new developments and expansion of old developments, and I do not look for any material improvement in these conditions until the fear of our becoming involved in foreign quarrels is gone, and also until our people can get a better idea as to what our industrial condition will be when the war is over. Many people feel that a great industrial boom in this country will follow the termination of the war. Others think that directly opposite conditions will prevail, particularly if no changes are made in the meanwhile in the tariff. They believe that when the war is concluded European factories will be found practically intact, and the necessity for employment, and particularly the necessity for immediately producing the largest possible factory output in order to meet war taxes, will be so great that European labor and European manufacturers, under the guidance of their respective governments, will immediately rush production to the utmost and will make wages and commodity prices low enough to overcome all competition in selling goods, and that under these conditions the Europeans are bound to cut under our prices so that we shall be swamped with foreign goods. They think that such an effect will be facilitated by the short hours and high wage scales established at the war-order factories in this country and also by the present low tariff.

"Without expressing my own opinion as to this, I am sure that capital will be timid and new developments will be delayed until investors are better assured as to the outcome than is now the case.

"The advent of so many war orders in a large number of Eastern cities is proving very helpful to the electrical business. The same may be said as to some of the metal-mining industries. On the other hand, business conditions in the lumber and fruit countries of the Pacific Coast are greatly depressed, and nearly all public utilities in that section are suffering accordingly. The same thing applies, but in less degree, to conditions in some of the Southern States. S. Z. MITCHELL.

"Electric Bond & Share Company, New York."

Byllesby Syndicate Finds Business Generally Dull

"My point of view on the effect, if any, of the European war upon the American electrical industry naturally is that of the local public utility company. We are connected with a large number of local utilities in the Middle West, the South, the Northwest and on the Pacific Coast.

"I would say, broadly, that there has been a very pronounced adverse effect upon the business conditions of the United States due to the European war. In the first place, it has practically stopped all financing on a large scale and particularly for new enterprises. In sections which have profited directly from war orders or from the crop situation due to the war there is a certain degree of artificial stimulation.

"In general we find business in the cities and towns

in which we operate to be at least dull, in most cases 'marking time,' and in the Puget Sound and Pacific Northwest section to be increasingly stagnant, this latter situation being more or less influenced by the depression in the lumber trade, which is not altogether due to the war, and to a general collapse following over-expansion in that section.

"Minnesota, Wisconsin and the Dakotas are enjoying a great period of prosperity due to the fundamentally sound financial conditions of those States, to their vast accumulated wealth, to their crop situation and good prices. We have a company operating in the zinc section of northern Illinois and southern Wisconsin. This company is enjoying a phenomenal prosperity due to the huge demand for spelter for the manufacture of munitions of war. California has done well and can be regarded as fairly prosperous, as it has profited directly from the tourist travel which has been diverted from foreign countries, as well as from the large number of travelers, leaving always substantial sums of money, attracted by the expositions.

"In general, I would repeat that the war has had a most distressing effect upon business. It has stopped large financing of a permanent nature, and there is, I think, on the part of all responsible people a feeling of very great anxiety and apprehension as to the future of our own country as judged by the portentous events involved in the present European war.

"H. M. BYLLESBY.

"H. M. Byllesby & Company, Chicago, Ill."

The U. G. I. Properties Note No Change

"After a careful analysis of the operating results of the various electric light and power companies in which we are shareholders, comparing the first six months of 1915 with the first six months of 1914, I do not think that any of the variations in volume of sales or in operating results can be charged or credited to the European war. Of course, there has been some increase in construction costs owing to advances in copper. Should the war continue for another year, and American concerns continue to rush into the manufacture of supplies for the belligerents at phenomenal profits, of which labor is justly claiming a share, I foresee possible unrest and misunderstandings in other industries.

"I cannot but feel that it would be for the common good of labor and capital if the concerns which are growing rich on war orders, instead of establishing high wage schedules, which cannot be maintained when business conditions become normal, would arrange with their employees to set aside for labor a percentage of their phenomenal profits, to be divided, say, every three months. SAMUEL T. BODINE.

"The United Gas Improvement Company, Philadelphia, Pa."

Referendum Delays Cincinnati Ordinance

The filing of a petition for a referendum on the new electric ordinance in Cincinnati, Ohio, will probably operate to delay the inauguration of new rates, even if they are ordered by the Ohio Public Utilities Commission. If the new rates depended upon the outcome of the appeal to the commission, the company would have been compelled to furnish a large bond, and if a rate lower than the old one had been granted finally, consumers would have received a rebate from the date when the ordinance would have gone into effect, Aug. 12. The referendum petition, it is said, will delay the operation of the ordinance until after the November election, no matter what the commission decides.

President W. W. Freeman of the Union Gas & Electric Company has expressed his willingness to furnish a bond, but said that in all probability a legal question will be raised as to whether the appeal to the commission or the referendum petition acted as a stay in regard to the ordinance.

"Electrical Prosperity Week" Campaign

According to an announcement of the Society for Electrical Development, Inc., "Electrical Prosperity Week" is the pioneer nation-wide trade campaign of history. No industry ever before undertook a sales and educational movement of this magnitude. No campaign of similar nature has ever received as much publicity as has been given already by the newspapers and technical and trade press to this celebration. Reports from the society offices state that enough assurances of co-operation have been received from the electrical industry to make the campaign a success.

The newspaper publicity which the society has received has been based on an editorial analysis of "electrical prosperity." When "prosperity" became part of the campaign the entire undertaking, its purposes, details of its plans and the men behind it, became legitimate and desirable matter for the newspapers. "Electrical Prosperity Week" benefits from the discussion about "prosperity." The country-wide movement undertaken by the electrical industry to convince the public that the nation has every reason to be optimistic over the business outlook and prosperous drew attention and will continue to do so.

The staff of the society is confident that as a result of the campaign and the use of "prosperity" more will be read about electricity and the men of the industry. More opportunities will come to tell again the magic story of electricity of the last twenty-five years; more liberality among the newspapers toward the achievements of electricity will be shown, and in the public mind more desire to possess comforts and economies of electricity will be created.

The campaign has been productive in obtaining new members for the society. Twelve large central stations controlled by one of the holding companies joined the society last week. The "Electrical Prosperity Week" campaign has awakened interest and financial support.

The national campaign will be carried on in the different localities by the local committees which have been appointed. On these committees are prominent workers in the respective districts. Already preliminary meetings have been held to discuss plans.

The Jovians are especially interested in the campaign. Several of the local leagues have appointed committees to work with the local "Electrical Prosperity Week" committees. One of the first Jovian leagues to become actively engaged was the St. Louis Jovian League of Electrical Interests, of which Mr. F. D. Beardslee, commercial manager Union Electric Light & Power Company, is president.

Mr. James R. Strong, past-president of the National Electrical Contractors' Association, in a recent address urged contractors everywhere to support the movement. "Support the society in its work," he said, "and especially labor assiduously to make 'Electrical Prosperity Week' a gala occasion and one long to be remembered."

The staff of the society believes that the "Electrical Prosperity Week" campaign will awaken the industry to the full appreciation of what might be done to spread the doctrine of "Do it electrically," but to "cash in" on the campaign individual sales campaigns must be conducted. The date of the week makes this easy as it is the beginning of the Christmas "shop early" campaign. The national educational work will create the desire for things electrical; the local interests must make the sales.

Saving $1,500 a Month by Using Electric Pumps

How the Substitution of Motor for Steam Drive Effected Economies in Operation of Iron Mine at Wharton, N. J.

BY E. E. YENSEL*

THE replacing of steam-driven pumps by motor-driven centrifugal pumps and the economy in operation resulting at the Richard mine of the Thomas Iron Company, Wharton, N. J., furnish conditions and data for profitable study. The Richard mine is one of the largest in that section of the country, and the installation of electrically operated pumps in this mine has been the subject of considerable investigation.

The types of pumps replaced and used to pump water from the mines are illustrated herewith. The pump in Fig. 3 is one of two of the plunger type installed on the 700-ft. level. Two reciprocating pumps were installed on the 800-ft. level and handled all water from this level to the 700-ft. level. Another reciprocating pump on a 1000-ft. level was the lowest unit in the series. The pumps in Fig. 3 raised the water from the 700-ft. level to the surface. The boiler room was 2000 ft. from the pumps at the 700-ft. level, 2100 ft. from those on the 800-ft. level, and 2300 ft. from the pump on the 1000-ft. level. The cost of operating these five pumps is shown in Table I.

TABLE I—COST TO OPERATE STEAM PUMPS PER YEAR

Six pumpmen (two per shift and three shifts), at $1.93 per day each	$4,266.70
Three firemen (one per shift and three shifts), at $2.15 per day each	2,354.25
Coal, packing, repairs on pump and boilers, and miscellaneous supplies	21,692.33
Total	$28,273.28

The motor-driven pumps which replaced the steam pumps are of the sizes shown in Table III, and are installed on the levels named.

Pumps Nos. 3 and 4, on the 500-ft. level, handle all water up to the 800-ft. level. From this point pumps Nos. 1 and 2 raise the water to the surface. The cost of operating the motor-driven pumps from Sept. 8, 1914, to June 23, 1915, is shown in Table II.

TABLE II—COST TO OPERATE ELECTRIC PUMPS PER YEAR

Sept. 8 to Oct. 23, 1914, 66,900 kw.-hr.	$805.73
Oct. 23 to Nov. 24, 1914, 43,100 kw.-hr.	526.70
Nov. 24 to Dec. 23, 1914, 57,400 kw.-hr.	626.80
Dec. 23 to Jan. 20, 1915, 54,200 kw.-hr.	600.70
Jan. 20 to Feb. 25, 1915, 80,800 kw.-hr.	865.56
Feb. 25 to March 24, 1915, 66,400 kw.-hr.	764.76
March 24 to April 23, 1915, 87,000 kw.-hr.	908.96
April 23 to May 22, 1915, 83,900 kw.-hr.	887.26
May 22 to June 23, 1915, 70,900 kw.-hr.	796.26
Total	$6,782.73
Estimated three months' bills at $700 per month, as there will be a little less water to pump on account of the dry season	2,100.00
Total	$8,882.73
Three pump men (one per shift and three shifts) at $1.93 per day each	2,113.35
Total	$10,996.08
Total cost with electric pump per year	$28,273.28
Total cost with electric pump per year	10,996.08
Total saving	$17,277.20

One electric pump on the 500-ft. level and one electric pump on the 800-ft. level handle all of the water except in the spring of the year, when it is necessary to run both pumps on the 500-ft. and 800-ft. levels.

*District superintendent of Eastern Pennsylvania Power Company of New Jersey.

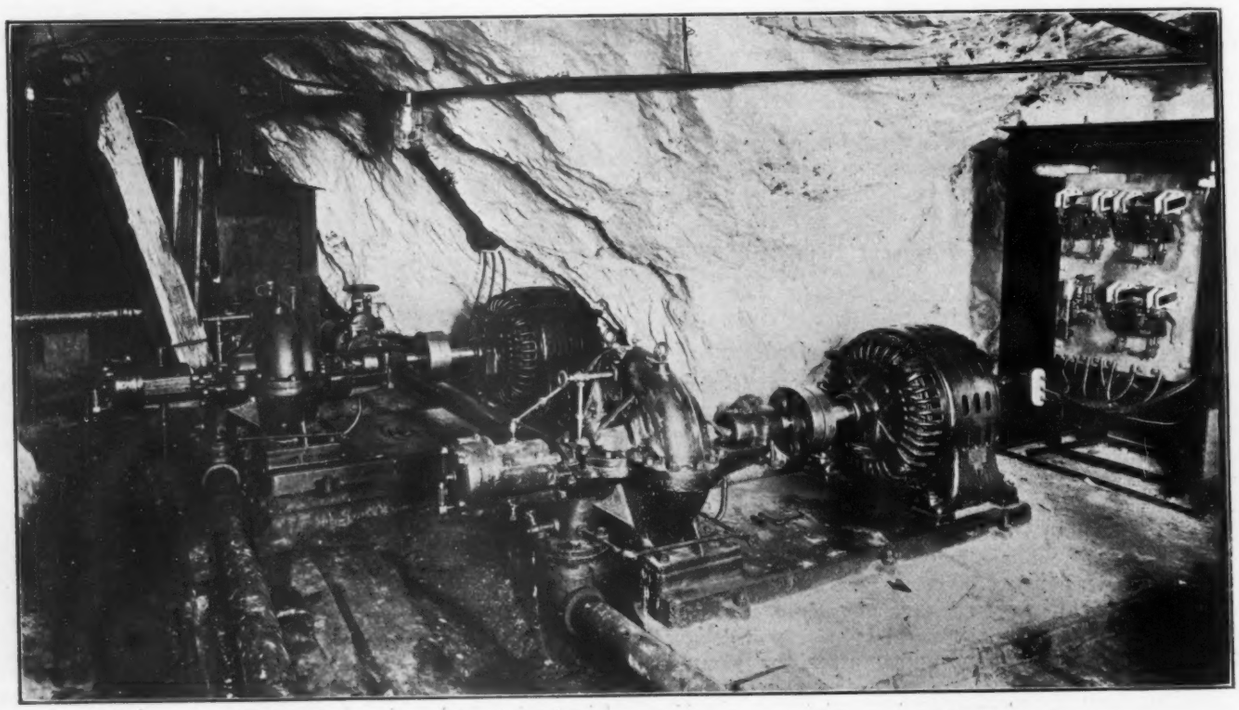


FIG. 1—MOTOR-DRIVEN CENTRIFUGAL PUMPS INSTALLED AT 800-FT. LEVEL IN RICHARD MINE

The motors are operated from the lines of the Eastern Pennsylvania Power Company of New Jersey. A transformer bank consisting of three 75-kva., 2300-to-550-volt transformers installed at the mine serves four

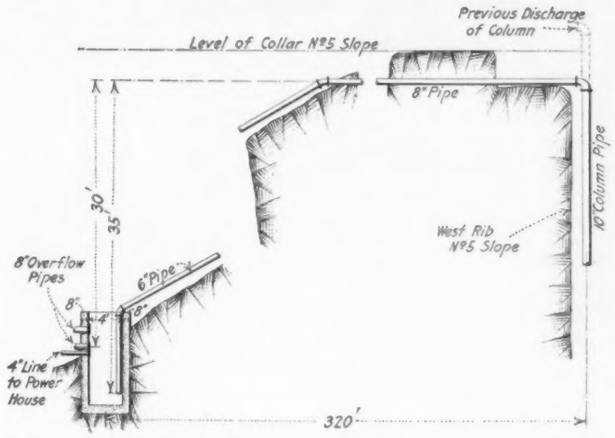


FIG. 2—VERTICAL SECTION OF MINE, SHOWING ARRANGEMENT TO REDUCE HEAD ON PUMPS AT 500-FT. LEVEL

50-hp., three-phase, sixty-cycle, 550-volt, 1800-r.p.m. Fairbanks-Morse induction motors, directly connected to Cameron centrifugal single-stage pumps with a rating of 300 gal. per minute, operating at a pressure of 174-lb. gage and 1750 r.p.m. All the motors operate automatically with a float-switch control through a Cutler-Hammer automatic switchboard.

Electric light in the mine is supplied from the motor circuits by using five 110-volt lamps in series at 550 volts. All electrical energy is metered on the primary side, and the mining company stands transformer losses. This character of load is a very desirable business from a central-station standpoint, as it is steady for twenty-four hours a day. In commenting on the operation of the pumps and the cost of the motor service, Mr. R. H. Sweetser, president of the Thomas Iron Company, says:

"The pumps have now been in continuous operation since the middle of September, 1914. There have been only two shut-downs due to interruptions of service, and in neither case has the delay been long enough to fill up our sump, which is capable of taking care of eight hours' extra flow of water.

"Last August, while running the steam pumps alone, we found that the total power necessary for pumping cost us $2,876 for the month. Our cost for the month of December, 1914, for power for pumping was only $626.80. The total reduction in coal in our power plant on account of installation of the electric pumps amounts to $1,500 per month. We are pleased to say that the saving was a little more than anticipated because none

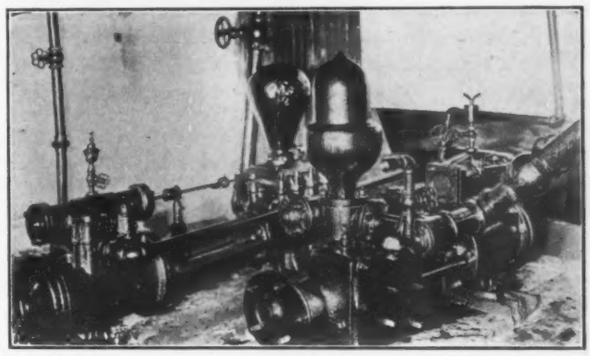


FIG. 4—STEAM-DRIVEN PUMPS FORMERLY USED AT 800-FT. LEVEL IN RICHARD MINE

of the engineers estimated the saving due to eliminating the pumping of the condensed steam of three 250-hp. boilers serving the steam pumps which exhausted into the sump at the bottom of the mine.

TABLE III—SIZE AND LOCATION OF MOTOR-DRIVEN PUMPS

No. Pump	Size of Motor, Hp.	Type of Pump	Stages	Rating, Gal. per Minute	Level Location, Ft.
1	50	Cameron Turbine	2	300	500
2	50	Cameron Turbine	2	300	500
3	50	Cameron Turbine	2	300	800
4	50	Cameron Turbine	2	300	800

"We have also reduced the amount of power necessary to operate the pump at the 500-ft. level, because we have installed a 'siphon' which produces a vacuum of about 17 in. This takes off considerable head and enables the upper pump to start up more easily.

"We find that the cold water from the mine at present is handled and used much more advantageously than the warm water that contained all the condensed steam. This cold water is used for the inter-cooler of our air compressor."

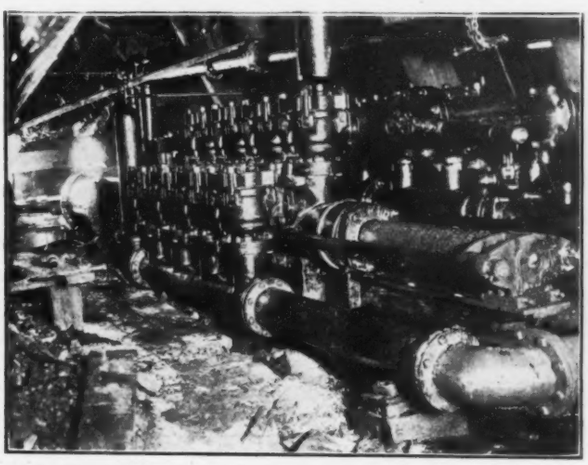


FIG. 3—STEAM-DRIVEN PLUNGER PUMP FORMERLY USED AT 700-FT. LEVEL IN RICHARD MINE

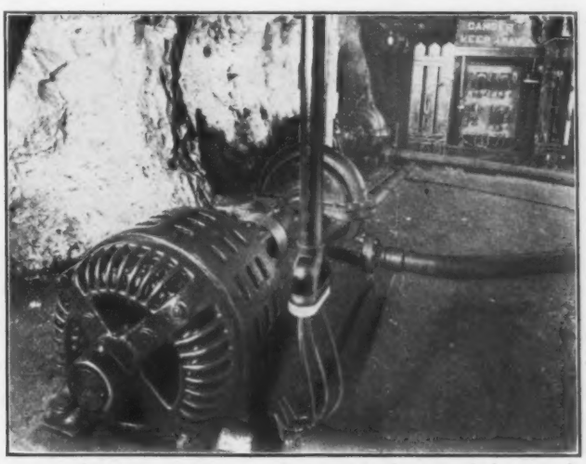


FIG. 5—MOTOR-DRIVEN CENTRIFUGAL PUMPS INSTALLED AT 500-FT. LEVEL IN RICHARD MINE

Protecting Buildings Against Lightning

The Functions and Effectiveness of the Lightning Rod Considered in the Light of Modern Theory and Practice

BY GEORGE H. ARMSTRONG

THE effectiveness of lightning rods is now unquestioned. At one time misuse by charlatans and a misconception of the principles involved placed under suspicion the whole lightning-rod industry. Now the principles are fairly well understood, and statistics prove that rodding affords protection in practically every case where the installation is intelligently made. Skill, experience and judgment are, however, necessary in erecting such rods.

The lightning rod has two functions: (1) *To prevent discharges.* This it does through the action of the points which permit the electricity to leak from the structure. Usually the leakage is rapid enough so that the electric charges of the cloud and the building are neutralized and a discharge is prevented. But if the charges accumulate so rapidly that the leakage from the points cannot neutralize them and a stroke occurs, then the lightning conductors (2) *prevent damage by conducting the lightning-stroke current to ground.* If there are no conductors forming a low-resistance path to ground, the stroke will select its own path, which will be of relatively high resistance and will probably damage the building or set it on fire.

Magnitude of Electrical Quantities in a Lightning Flash

The following approximate values of the magnitude of the electrical quantities in a lightning flash have been estimated by Steinmetz, who points out that the discharge is probably oscillatory: Average potential gradient, 50,000 volts per foot at the moment of discharge; average potential difference between different points of the cloud, 50,000,000 volts; average current in the discharge, 10,000 amp.; average duration of the discharge, 0.00005 second; average frequency of the discharge, 500,000 cycles; average energy of the discharge, 10,000 kw.-sec., or 7,000,000 ft.-lb.; average power of the discharge, 250,000,000 hp.

The energy of a lightning discharge of the above characteristics is, however, really not very great, inasmuch as 10,000 kw.-sec. or 7,000,000 ft.-lb. is about the energy required to evaporate about 9 lb., or a little more than a gallon, of water. This could be done in a short time by any gas or coal stove. The violence of a lightning stroke is due to the fact that this energy is dissipated in such an inconceivably short time, viz., 0.00005 second.

Damage done by lightning may be divided into two general classes—heat-effect damage, as, for example, where telephone or power conductors or other metal members lying in the path of the stroke are fused; (2) mechanical disruptive disintegration; for example, the splitting of a tree, the breaking of a rock or the overturning of a stack.

Lightning seldom damages certain objects. In so far as the writer has been able to ascertain, lightning has never been known to damage seriously (1) railroad trains or locomotives, (2) buildings with metallic grounded sides and roofs, (3) buildings having frameworks wholly of metal, (4) grounded steel windmill towers, (5) steel battleships, and (6) business blocks in cities. Apparently all of these objects conduct electricity sufficiently well for electricity induced on the earth by a cloud to be drawn up through them and dispersed by the point action before the difference of potential between the cloud and the object becomes great enough to produce a flash. If a lightning stroke to such an object does occur, the mass of metal in it is usually sufficient to conduct the current safely to ground. Conversely, lightning often damages non-conducting objects such as country homes and barns, wooden-frame schoolhouses and churches, stacks, trees, cattle and horses, particularly where the stock is near wire fences.

The Thunder Cloud Explained in Terms of Electrostatics

The theory of the lightning rod may be explained by reference to Figs. 1, 2 and 3. If an electrified cloud *A* (Fig. 1) passes over any portion of the earth, it will induce a charge of electricity on that portion. The cloud, the intervening atmosphere and the surface of the earth really constitute a large electric condenser.

A heavy charge will be drawn by mutual attraction to the highest portions of objects that are near or directly under the cloud. In Fig. 1, if the cloud is positively electrified, a negative charge will be induced and attracted from the earth up over the outer surface of the building shown. If the building has a metallic or other surface that is a good conductor, the charge will rise (flow) rapidly. If it is of brick, stone or wood, which are only fair conductors—but they are conductors—the charge will rise (flow) slowly. It cannot, however, leak rapidly, because the material of the building is a poor conductor; hence the electricity cannot flow over its surface rapidly. The consequence is that the building will lie within a static field that is built up as suggested in Fig. 1.

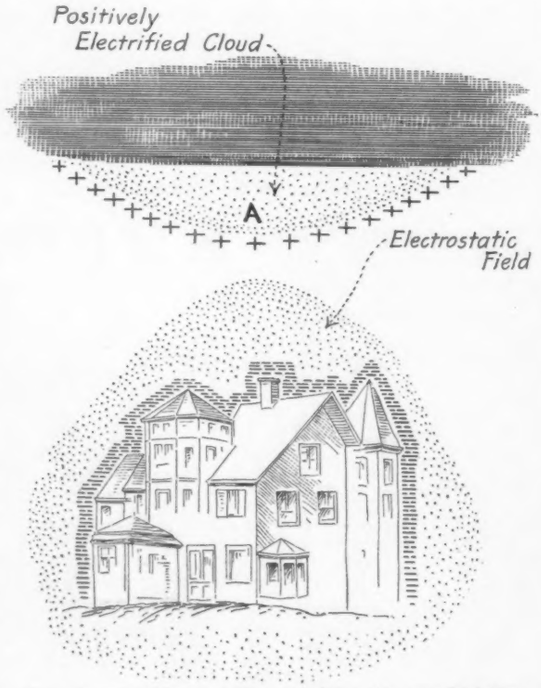


FIG. 1—ELECTROSTATIC CHARGE ON UN-RODDED BUILDING

If the building is rodded and equipped with points as shown in Fig. 2, the charge on the building, induced and attracted by that on the cloud, will rise rapidly, and it will discharge freely from the sharp points. The probabilities are that the flow of electricity from the points will so

decrease the potential difference between the cloud and the building that no lightning stroke will occur. The presence of the grounded lightning conductor and the points has a tendency to raise the static field above the building, as indicated in Fig. 2.

Now if the charge on the cloud accumulates very rapidly, the corresponding charge on the building will

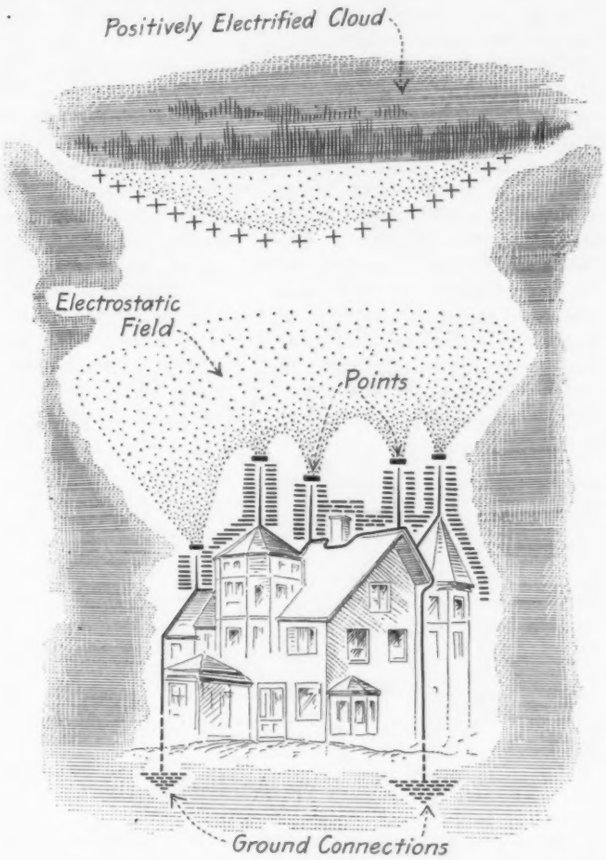


FIG. 2—CHARGE INDUCED ON RODDED BUILDING

increase faster than the points can discharge it. If it thus increase to such a value that the potential difference between the cloud and the building exceeds the breakdown value of the intervening atmosphere, a lightning stroke (Fig. 3) will occur between the cloud and a lightning-rod point. If the lightning conductors and their grounds are adequate, the charge will be conducted to the earth without damage to the building.

A building may be struck even if it is rodded if the charge accumulates so fast that the points will not disperse it. Consider Fig. 4, which illustrates one case where a heavy charge may accumulate on a building in much less than a second. Clouds *A* and *D* are floating relatively near each other, and *A* is over a rodded building. The potential of *D* suddenly reaches such a value that it discharges to ground, making the stroke *C*. This causes a discharge stroke between *A* and *D*. Now, there is a great difference of potential between *A* and the building, and a flash *E* occurs to neutralize it. All this happens instantaneously so that the points on the building cannot leak rapidly enough to prevent the discharge *B*, although they probably weaken it. The lightning conductors should conduct the discharge of *B* into the ground without damage to the building.

Materials for Lightning Conductors

Of the materials suitable for lightning conductors or rods, copper is probably the best, because it is a good conductor and will not corrode. Electrically, iron is also satisfactory if it is of sufficient section, but it will ultimately corrode, even if it is galvanized, and may therefore fail just when it is most needed. The contact of dissimilar metals should be avoided in a lightning-rod installation because of the liability of electrolytic action and the consequent corrosion. Some insurance companies will not accept risks rodded with iron conductor. A conductor of flat form (rectangular cross-section) appears to be preferable from a theoretical standpoint, and it is a convenient form to handle and to connect with mechanically. Practice indicates that material of any cross-sectional form will give adequate protection if it has sufficient weight per foot, that is, if it is big enough.

In the matter of installation of lightning conductors, the rodding must always be held in metallic connection with the surface of the building by cleats, clamps or staples, so that an electric charge on the building's surface can readily be conducted to the points where it can disperse. Round conductor can be held with straps like those of Fig. 5. Flat conductor is spliced by lapping the ends and nailing a copper strap across them with copper nails. Round conductor is spliced with a sleeve (Fig. 6). The routing of the conductor over the sur-

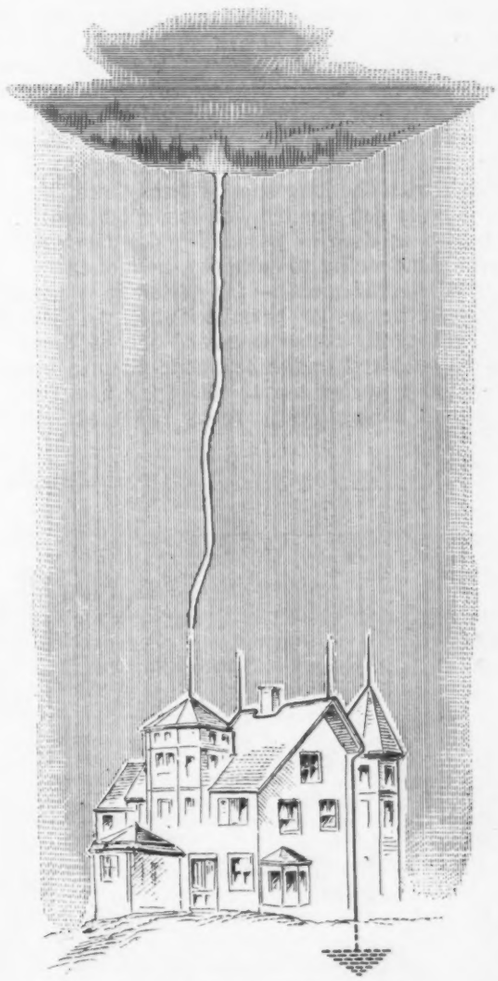


FIG. 3—THE LIGHTNING FLASH

face of a building is an important feature. Where possible, the conductor is grounded at one corner, run over the building as shown in the following sketches, and then again grounded at the furthest opposite corner. The longest straight portion of the conductor should divide the surface of the building into two equal portions as nearly as may be possible. Where addi-

tional grounds are required, the wires from them should divide the main wire into equal sections as nearly as possible. Conductors should, where possible, be carried down along the corners of buildings rather than on their sides. All adjacent metal members of the building must be connected with the conductor, grounded, or both.

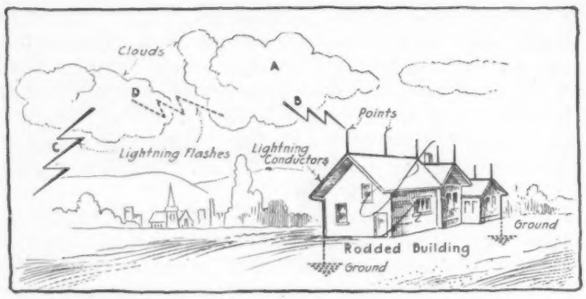
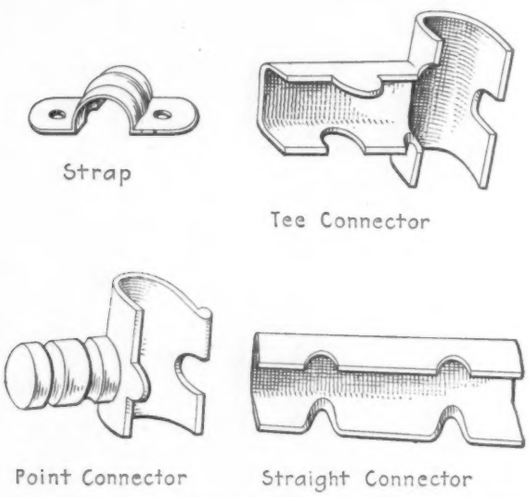


FIG. 4—HOW GREAT DIFFERENCES OF POTENTIAL MAY BE DEVELOPED SUDDENLY

The Importance of Ground Connections

Ground connections for lightning conductors are usually made as shown in Fig. 9. A hole, 10 in. deep, is dug with a long-bladed shovel. Water is poured into the hole and the long drill (Fig. 10) is forced down 10 ft. Into this hole the conductor end is placed and the earth is tamped around it. If the earth at the surface is hard, the hole can be started with a short drill and completed with the long one. Where there is rock and a deep hole is not feasible, the conductor end is buried in a trench as deep as possible and a large flat stone laid over the opening to conserve the moisture. A contact of dissimilar metals—for instance, iron and copper—should never be permitted because electrolytic action will surely cause decay of one of them. Ammonia encountered in the soil near manure heaps will eat through a buried copper conductor in a few years. The ground connection is really the most important feature of an installation. On its integrity depends the effectiveness of the whole job. It cannot be made too carefully.



FIGS. 5 AND 6—FITTINGS FOR ROUND CONDUCTOR

Lightning-rod points disperse into the atmosphere the electric charge that has accumulated on the building. The points illustrated in Figs. 11 to 14 are now largely used. Experience has, apparently, shown the short point to be as effective as the long one. Copper tubes, pointed at their upper ends, usually constitute the conducting portions of points. Pointed iron rods are used where the lightning conductor is of iron. Glass balls, vanes and the like on points of the weather-vane type are for ornament only and have no part in the electrical operation of the contrivance.

Metallic members, both within and on the outer surface of a building, should be connected with the lightning-rod system. If this precaution be not taken, side flashes may occur. Where the lightning-rod conductor lies within 6 ft. or less of any large body of metal or of the pipes of a water or heating system, the metal bodies should be connected to the rodding at the highest point available—in the attic if possible. Piping systems within a building should also be connected electrically to each other in substantial manner at the highest available point, whether or not they are connected to the rodding. These connections should be made at the high portions of the building because the electric charges induced on the metal members will be attracted and held at these high portions by the inducing cloud. Unless the interconnections are high up within the building, these bound charges cannot flow away. For similar reasons, hay racks, metal drinking troughs and barn-door rails should be substantially connected to the rodding. The connection should be made at both their ends if possible.

FIG. 7—PROTECTION OF L-SHAPED BUILDING

Protecting Power-Plant Stacks

Brick or masonry stacks of power stations and factories should always be rodded, particularly if the stack is in the open—that is, not surrounded by other buildings. A stack extending to a considerable distance above the surface of the earth constitutes an attractive route to ground for a lightning-discharge current. Furthermore, the heated ionized gases rising from the stack are themselves a very good conductor and so extend the conducting path many feet above the top of the stack.

It might be assumed that when a stack is struck the lightning current will follow this smoke conductor to ground. Sometimes it does, but in many unfortunate cases, for reasons that are not readily evident, the current will pass to the ground, for a portion of the distance at least, through the masonry of the stack. As a result, the masonry may be cracked and portions of it be blown out or utterly demolished. Rodding installations for high stacks should be quite elaborate, and cannot be adequately treated here. Metal stacks should be effectively grounded at their bases. The reinforcing of concrete stacks should be well grounded, and at their tops points or air terminals connecting with the reinforcing steel should extend out and up into the air. If this precaution is not taken and lightning strikes a reinforced-concrete stack, some of the concrete may be broken away, but probably no other damage will be done.

Hazards of Telephone Lines and Wire Fences

Protection for telephone wires is also essential. If it is not provided, lightning discharge current may enter a building along the wires and cause damage. The lightning arresters ordinarily furnished by the

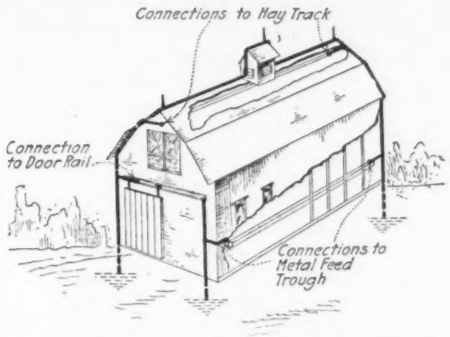
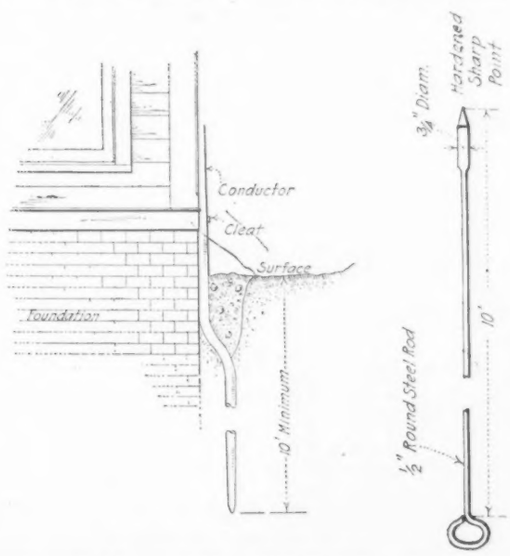


FIG. 8—PROTECTION OF BARN STRUCTURE

telephone companies are of too frail construction to provide protection against a lightning stroke of any consequence. For this service, protectors or arresters of very sturdy construction should be mounted outside the building and well grounded.

Wire fences should be grounded at frequent intervals. If they are not, a lightning-stroke current may follow along a fence wire and into a building and start a fire. However, the most important reason for grounding is to prevent the killing of stock. During a storm the animals crowd against the fence, and when a lightning discharge strikes an ungrounded fence wire, it will seek the path of least opposition to ground, which may be through an animal near or against the fence wire. The result is usually fatal.

A very complete summary of directions for installing lightning rods on residences, barns and ordinary buildings has been prepared by Mr. W. H. Day of the On-



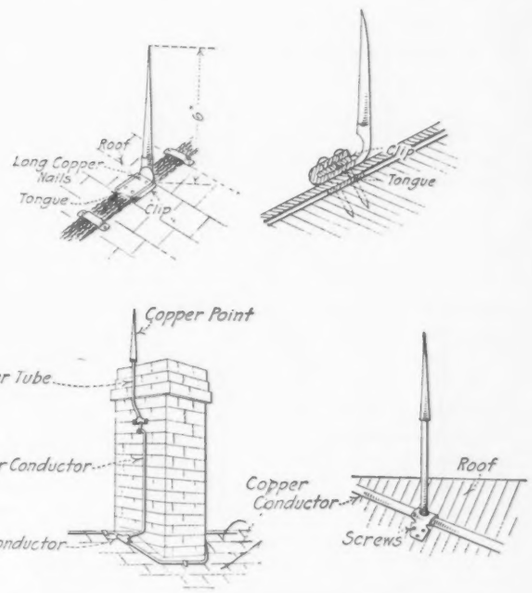
FIGS. 9 AND 10—GROUND CONNECTION AND DRILL TOOL

tario Agricultural College. This summary is substantially as follows:

Directions for Installing Lightning Rods

Kind of Rods.—Material—Copper, aluminum or galvanized iron, preferably the first because of durability. Aluminum may prove equally durable. Combinations are not advised, because not as durable as single-metal rods. Weight—Copper, at least 3 oz. per foot; aluminum, at least 2¼ oz. per foot; steel (iron), at least 4½ oz. per foot. Form—Any form that will give durability and convenience of installation.

Ground Connections.—Depth—Down to perpetual moisture; at least 8 ft. Number—On an oblong building, at least two; on an L-shaped or T-shaped building, at least three; on a U-shaped building, at least four. Location—Preferably at opposite corners, though this may be modified to avoid manure or to go down near conductor pipe or other metallic portion of the structure. If the conductor pipe is on the side of the building, the ground rods should be at the corners, as above stated, the eave troughs connected to it, and then the conductor pipe also grounded. Ground rods should not be bunched and should be distributed as well as possible. Method—In deep soil drill a hole at least 8 ft. deep and run cable down. In shallow soil attach cable to metallic ground-plate, which is put down as deep in soil as possible, or run it into a well or a stream or a crevice in the rock. If none of these is feasible, bury



FIGS. 11 TO 14—ROOF AND CHIMNEY POINTS

cable as deep as possible and lay large, flat stone over it. Caution—Be present and see that ground connections are properly made. The rest of the system may be inspected at any time, but the groundings can be seen only when they are being put down.

Systems.—Run cable from ground up corner to eave, thence to ridge, along ridge to other end, thence down to eave, thence to other ground, making a complete circuit. All cables should be connected in one system. No stubs or dead ends should be left ungrounded. Caution—Cables should be protected from ground 6 ft. or 8 ft. up by nailing boards around them.

Attachment.—Fasten cable to building with nails, clips or metal "dispensers." Caution—Do not use insulators.

Points.—Number—20 ft. to 30 ft. apart. Location—On ridge, first ones not over 5 ft. from end; on or beside chimneys or cupolas; on dormers; also on silos. Height—4 ft. to 5 ft., except those on or beside chimneys, cupolas or similar prominences; these must extend at least 18 in. above the highest part. Form—Strong tubes, of same weight and material as rods.

Metallic Portions of Structure.—Roof Gutters—Top connected to rod and bottom grounded. Eavetroughs and Conductor Pipes—Free end of eavetroughs con-

nected to rod and conductor pipe grounded. Hayfork Track—Both ends connected to rod. Tanks—Connected to rod above, grounded below. Windmill—Connected to rod above, shaft grounded below. Metallic Roof—Grounded at two or four corners, not from peak under any consideration. Points should be used on the ridge and other prominences.

Wire Fences.—In Field—A grounding at least every 20 rods. In Yards—At the four corners. At Building—Ground at first post from building. Weight of Groundings—Equal to three No. 12 or one No. 9 wire. How Made—Stapled on posts in contact with all wires of fence, extending at least 3 ft. in the ground and projecting above fence.

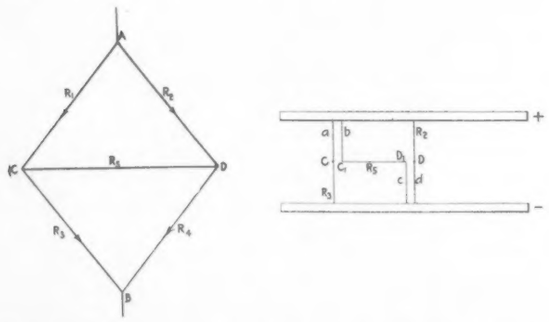
Shade Trees.—Protect where feasible with a grounded wire running to their tops.

Equivalence of Wheatstone Bridge to Three Parallel Circuits

BY A. H. ADAMS

Some time ago the writer had occasion to make use of a Wheatstone bridge a large number of times in the course of certain work relating to printing telegraphs. Not having handy a pocket-book containing the usual formulas, and having a distaste for the labor of solving the usual six simultaneous equations, he stumbled upon the method here described. Several mathematicians to whom this method has been shown have stated that, so far as they were aware, it is new. It is therefore here presented for the consideration of any other engineers who may be confronted by a like problem.

Consider a bridge with leg resistances R_1, R_2, R_3, R_4 and bridge resistance R_5, as shown in Fig. 1. Let the battery current flow through the bridge in the direction from A to B. It is easy in any given case to determine by inspection the direction of the current in the bridge resistance R_5. Assume this direction to be from C to D. The formulas here developed depend on this assumption; i.e., the formulas are not general, but depend upon C being at a higher potential than D. In other words, in



FIGS. 1 AND 2—WHEATSTONE-BRIDGE CIRCUIT, AND THREE-PARALLEL-CIRCUIT EQUIVALENT

the formulas and discussion R_1 and R_2 are assumed to be related to R_3 and R_4 by the following inequality:

$$\frac{R_1}{R_2} < \frac{R_3}{R_4}.$$

With this limitation the bridge may be considered equivalent to three parallel circuits (shown in Fig. 2) in which the points C and C_1 and the points D and D_1 are respectively at the same potential, and in which the resistances a, b, c and d are so chosen that the combined resistance of a and b in parallel is R_1 and the combined resistance of c and d in parallel is R_4. Under these conditions the three parallel circuits in Fig. 2 are in every way equivalent to the bridge circuit in Fig. 1, for the points C and C_1, being by hypothesis of equal potential, may be joined without changing the distribution of the currents, and when so joined the multiple path a and b is of resistance R_1. Similarly, D and D_1 may be joined, giving a multiple path through c and d of resistance R_4.

The conditions imposed upon a, b, c and d may be expressed mathematically as follows:

$$\frac{ab}{a+b} = R_1, \tag{1}$$

$$\frac{cd}{c+d} = R_4, \tag{2}$$

$$\frac{a}{b} = \frac{R_3}{c+R_5}. \tag{3}$$

$$\frac{d}{c} = \frac{R_2}{b+R_5}. \tag{4}$$

These four simultaneous equations may be solved very easily for a, b, c and d in terms of R_1, R_2, R_3, R_4 and R_5. In many numerical examples, if not in most, it is as simple to write down these four equations with the numerical values of R_1, R_2, etc., and to solve directly, as it is to substitute the values of R_1, R_2, etc., in the general literal solution. For the sake of completeness, however, the values of a, b, c and d in terms of R_1, R_2, etc., are given below, together with the more important steps in the solution.

From (3), $$\frac{a}{a+b} = \frac{R_3}{R_3+R_5+c}. \tag{5}$$

From (4), $$\frac{d}{c+d} = \frac{R_2}{R_2+R_5+b}. \tag{6}$$

From (1) and (5), $$R_1 = \frac{bR_3}{R_3+R_5+c}. \tag{7}$$

From (2) and (6), $$R_4 = \frac{cR_2}{R_2+R_5+b}. \tag{8}$$

From (7), $$b = R_1 + \frac{R_1}{R_3}(R_5+c). \tag{9}$$

From (8), $$b = \frac{R_2}{R_4}c - (R_2+R_5). \tag{10}$$

Equating (9) and (10) and solving for c, gives

$$c = \frac{R_4(R_1R_3+R_1R_5+R_2R_3+R_3R_5)}{R_2R_3-R_1R_4}. \tag{11}$$

By symmetry,

$$b = \frac{R_1(R_2R_3+R_2R_4+R_3R_5+R_4R_5)}{R_2R_3-R_1R_4}. \tag{12}$$

From (1) and (12),

$$a = \frac{R_1(R_2R_3+R_2R_5+R_3R_4+R_4R_5)}{R_2R_5+R_2R_4+R_4R_5+R_1R_4}. \tag{13}$$

And, by symmetry,

$$d = \frac{R_4(R_2R_3+R_2R_5+R_1R_3+R_1R_5)}{R_1R_5+R_1R_2+R_3R_5+R_4R_1}. \tag{14}$$

When the values of a, b, c and d have been obtained, the currents in the three parallel circuits are found directly by Ohm's law, and from these the bridge currents are readily determined. Also, this same equivalent circuit renders very easy the reverse problem, namely, given the currents in the five legs to determine the resistances R_1, R_2, R_3, R_4 and R_5.

The writer is of the opinion that this general method of constructing by inspection an equivalent circuit with equipotential points may also be found useful in the simplification of the solution of other and more complicated networks.

Mobile Color and Stage Lighting—IV

Principles Involved in the Selection of Pigments and Dyes—Advantages of Spectroscopic Studies of Absorbing Media

BY BASSETT JONES

THE three preceding installments of this article have dealt with stage illumination as an art susceptible of great artistic development and have given detailed descriptions of equipment devised to this end by the author and specifications for lamps designed for stage-lighting work. In the present installment the selection of pigments and dyes is dealt with and its underlying principles are outlined.

Pigments, Dyes and Color Filters

The selection of pigments, dyes and color filters presents the most difficult problem of the entire art. One must learn to think of color in quite an abnormal way. Two mental color scales must be available so that, while the actual scenery coloring is being done by daylight, the result is seen rather in terms of stage illumination; otherwise the results are quite certain to be unfortunate. This requires a re-molding, by experience, of the judgment for color. The writer has found that a "color booth"—a device in which light of any hue, purity or, within usual limits, intensity, could be obtained at will—served as a great aid in properly guiding the judgment. In this device pieces of fabric, having various texture and fiber qualities, dyed or pigmented in various ways, can be studied under a great variety of conditions. But, even though a careful study of the characteristics of pigments, dyes and color filters is made, the knowledge so obtained forms merely a starting point. Much depends upon the possession of a feeling for color value, of an appreciation of the proper relation between color massing and configuration. And this is only acquired, if at all, by constant association with objects that possess the required qualities. Perhaps it is a gift. At any rate, it is the most important acquirement of the stage artist.

However, the mass of facts relating to chromatics that can be gathered by experiment will, at least, serve as a guide to the best and most economical method of obtaining the desired results. In this the illuminating engineer may be of some assistance.

Obviously light absorption plays an extremely important part in the production of color, for practically all objects get their apparent color through their action in absorbing certain wave-lengths in the light by which they are illuminated. The sensation of color is aroused by the wave-lengths only partially absorbed and which are either transmitted through the object (a color filter) or reflected from it. Pigments and dyes act much in the manner of a color filter, for, if the coloring substance be not too dense, the reflected wave-lengths do not determine the dominant hue. The characteristic color is caused by the passage of the incident light through and between the coloring particles. Eventually, by repeated refractions and reflections, a portion of it finds its way back to the surface from which it appears to be diffusely reflected. Evidently a surface having a high coefficient of reflection is not a good means of showing color. The deeper into the object the light penetrates, the more characteristic and saturated will be its color when remitted. Of course there will be a correspondingly increased absorption, not only of the unnecessary wave-lengths, but also of the desired wave-lengths. This accounts for the soft, saturated and rich hues that can be produced in dyed fabrics, as the dye particles permeate the fibers and do not merely coat the surface.

Of course, it is not possible to produce with this scenery glaring and brilliant effects. Nor are such effects desired, for they lack one of the fundamentals of beauty—namely, restfulness. The color values are much purer and richer than can be produced with pigmented canvas, and, with the proper color filters, the control of the color is much more perfect. Dyes naturally lend themselves to this purpose as they are extremely saturated in hue. They can be desaturated by dilution, whereas pigments require the addition of zinc or magnesium white, both of which remain in the pigment body in the form of transparent particles. The dyed scenery shows little surface reflection such as is found with even the dullest painted surface. So that the light reflected from the dye particles is not changed in hue by admixture with a certain amount of the incident light reflected without modification. Furthermore, since the material used to produce the hue in the color filter is the same in character as that used to color the scenery, the task of selecting dyes is made somewhat simpler.

Spectral Analysis of Light Necessary

The limits of absorption can be adequately studied only by a spectral analysis of the incident light as well as the light reflected from and transmitted by the absorbing medium. It is necessary to study incident, reflected and transmitted light in order to determine just what wave-lengths are neither reflected nor transmitted but are absorbed. Many practical absorbing media, such as glass color filters having a polished surface or surface film differing in character from the body of the medium, show not only selective reflection, but also reflect light of the same or nearly the same character as the incident light, and also show more or less general absorption of all transmitted light. Some media show, in addition, marked selective absorption of more or less narrow ranges of wave-lengths.

Thus a green-glass color filter may reflect a large portion of the incident light, and, owing to selective reflection, if the color is dense enough, will show a characteristic purplish color in the reflected light, the color and the amount of selectively reflected light depending upon the composition, density and physical characteristics of the material used to color the filter. It will also be found that much of the light not reflected is absorbed—even including the green—the only reason that the filter appears green being that the green light is not absorbed to the extent that the other wave-lengths are absorbed.

We are then to distinguish between general absorption, when the absorbing power is nearly the same for all wave-lengths, and selective absorption, when the absorption is more or less limited in extent. Both types of absorption, as we have before pointed out, may, and in fact generally do, occur in one and the same medium. Most pigments and dyes show powerful selective absorption; as a rule, it is this fact that accounts for their marked color.

If the medium is homogeneous, the absorption is proportional to the thickness. If, however, the coefficient of the transmission varies for different wave-lengths, then the color of the medium will vary with its thick-

ness and may also vary with its density. Thus with white incident light most blue glass and gelatine filters will appear purplish with increasing thickness or with increasing density of the absorbing particles held in suspension. This phenomenon is known as diachromatism.

Again, the appearance of the light transmitted by color filters may vary greatly, depending on the color of the light used, because one light source more than another may emit a greater proportion of light in wave-lengths easily transmitted by the medium, or vice versa. A solution of cyanide and nitroso-dimethyl aniline in alcohol appears red by kerosene light and bottle green by daylight. It is very easy to find glass that is blue by transmitted light when exposed to daylight and a red purple when exposed to the light from a tungsten lamp.

While these examples exhibit exaggerated cases of diachromatism, the phenomenon appears to a greater or less extent in all practical and commercial color filters and makes their selection for required results somewhat difficult. Fairly good red and green color filters are readily procurable, but a blue filter that does not transmit some red seems to be commercially impossible. A glass that shows a fairly true blue when blown is almost certain to show purplish when reheated and rolled, owing to the chemical effect of the heat on the absorbing particles. Two yellow color filters may appear exactly alike by transmitted light, yet one may appear yellow because it transmits a predominant amount of the wave-lengths corresponding to spectral yellow, while the other may appear yellow because it transmits both red and green, the mixture of which looks yellow. Usually yellow color filters transmit red, yellow and green in varying proportions, so that the effect of the transmitted light on colored bodies showing selective absorption or selective reflection will be variable. Thus if the light transmitted appeared only yellow by mixture of red and green and the object lighted showed a selective reflection for the wave-length corresponding to special yellow—absent in the mixture—the object would not show its true color at all. It might appear a dingy yellow or it might look orange, or even greenish, depending on the relative values of the absorption coefficients or reflection coefficients for wave-lengths other than yellow.

Spectroscopic Studies of Absorbing Media

From what so far has been said, it must be obvious that absorption presents the greatest practical difficulties and deserves the closest attention. Spectroscopic studies of absorbing media are essential if any conclusions are to be drawn as to the result of mixing the light transmitted by such media or the effect the transmitted light will have on colored objects.

The most general cause of color in objects is the presence in or on the objects of pigment particles, for the material of which most objects is formed is, apart from the presence of such pigment particles, usually quite transparent and colorless. Pigments are characteristic in their high power of selective absorption and give to most objects both their body and surface colors.

The normal color of objects is the color the eye is accustomed to perceiving on the average when the object is illuminated by daylight. If daylight were of a different character from what it is—say, similar to the luminous radiation of a 4-watt-per-candle carbon lamp—then this would probably be normal white light to the eye, and objects would probably appear to have much the same normal colors they have at present.

The eye, however, possesses quite marked powers of adaptation to change in color of light, so that even when objects are illuminated by a light the color of which departs quite widely from normal daylight, the eye soon accustoms itself to the new color scale and is quite satisfied, even though normal blues look black and normal grays look brown. It requires a relatively sudden or very marked change in the color of light for the eye to become shocked at the change in the color of objects. Relatively slight changes in color balance, where color balance is of importance, as in paintings, color decorations and scenery, may, however, have an effect not at all commensurate with the change in the color of the illumination, because it is not merely sensation but the judgment of proportion that is disturbed.

It is obvious that where the pigment colors of objects correspond closely to pure spectral hues any change in the color of the light whereby such objects are illuminated can have no effect on their apparent hue, but only on their luminosity. A pigment that reflects only red light of a definite spectral hue cannot reflect light of any other hue. Hence any change in the hue of the light can affect only the color of the pigment by rendering it more or less brilliantly red, depending upon the intensity of the wave-lengths in the incident light corresponding to this particular red hue. Such a pigment may look black when there is no red component in the light, but it can never look violet, green or yellow, no matter how intense those components may be.

On the other hand, a pigment obtained by mechanically mixing two other pigments, the color of each corresponding to a definite pure spectral hue, would appear absolutely black under white light.

Pigments of Pure Spectral Hue Virtually Non-Existent

Such pigments of pure spectral hue, however, do not exist except in the case of certain dyes. If two such pigments could be found, one of a pure spectral yellow and one of pure spectral blue, then the mixture of these pigments would not appear green when illuminated by white light, but a very dull gray or black. The yellow pigment obtains its color under white light by absorbing all wave-lengths except those corresponding to its hue in color. Similarly for the blue pigment. Since the yellow pigment absorbs blue light and the blue pigment absorbs yellow light, the mixture would absorb all wave-lengths and would appear black under any illumination.

Few if any pigments and very few dyes obtain their color in this way. Their apparent color is due to a more or less general absorption of all wave-lengths accompanied by a preponderant transmission of those wave-lengths which give them their dominant hue. The hues of pigments are, therefore, never so saturated as spectral hues, and, furthermore, their colors are never so luminous as the spectral colors, because there is a more or less general absorption of all wave-lengths. The color of pigments is due to the fact that the coefficient of absorption is less for some wave-lengths than for others.

Such pigments can take the hue of any specific isolated spectral region in light used as an illuminant. The luminosity of the apparent color will, of course, depend upon the absorption coefficients of the pigment for wave-lengths in this region.

A yellow pigment, such as chrome yellow, for instance, does reflect not only spectral yellow light when illuminated by light showing a continuous spectrum, but also spectral red and spectral green, the mixture of which produces the sensation of yellow, and so may produce a fairly intense sensation of yellow. At the same time the pigment absorbs some of the spectral yellow, red and green components in the incident light and a greater proportion of all other spectral colors, so that its apparent color is not very luminous, although more luminous than other pigments showing dominant colors in less luminous regions of the spectrum. The pigment

reflects in some degree all spectral colors, the resultant of which, of course, produces a certain amount of white sensation so that its dominant hue is not greatly saturated.

The color of the usual pigments is, therefore, dependent entirely upon the spectral character of the illumination. A change in the intensity of a region of the spectrum shown by the light source serving as an illuminant far removed from the dominant normal hue of the pigment may seriously affect the apparent color of the pigment. Thus a reduction in the intensity of the blue spectral region of the illumination will shift the color of chrome yellow toward the red, at the same time increasing its saturation. This increase in saturation is due to the reduction in the quantity of spectral white reflected because of the diminution in the blue component—the degree of the blue visual process being correspondingly decreased.

Principles of Pigment Mixing

If, then, different colored pigments of this character be mechanically mixed together, the luminosity, purity, hue and saturation of the mixture will depend upon the combined coefficient of absorption of the mixture throughout the spectrum of the illuminant. Obviously all such mixtures will be much lower in luminosity than the luminosity of either of the separate components. The resultant color will be due to the particular wavelengths reflected after the combined absorption of all components of the mixture has had its effect. The purity of the hue of the mixture will necessarily be less than the purity of the hue of either component, so that its saturation will also be decreased.

As an example, if a green pigment be produced by the mixture of yellow and blue pigments and an attempt be made to match this mixture color with a natural green pigment such as emerald green, it will be necessary first to desaturate the emerald green with zinc white to decrease its purity and then to darken or break it with black in order to obtain a match in luminosity. The hue can be matched in the reverse order only by varying the quantities and character of the yellow and blue pigments used in the mixture.

A pigment whose color has been desaturated by the admixture of white can appear to be almost any color, depending upon the color of the light by which it is illuminated, because the white particles can have any hue impressed upon them. The luminosity of the apparent hue will, of course, depend upon the range of absorption shown by the pigment. Thus a pale blue pigment can look red under practically monochromatic red light, but its luminosity will be relatively reduced, owing to the absorption of red light by the blue pigment in the mixture. Since most of the pigments used for decorative purposes and for scenery painting are quite unsaturated, it is obvious that variations in the color of light may produce marked changes in the color arrangement. This fact may be used as a basis for an interesting play in color by the proper selection of pigments and suitable variations in the color of the illumination.

The dyes used for coloring cottons, wools, silks and scenery very frequently show marked and narrow ranges of absorption—sometimes they show several discontinuous regions of absorption, and occasionally they show similar narrow regions of selective reflection. Extraordinary series of color changes can be worked out with such coloring matters and with properly selected colors in light. The production of the proper color filters for use in producing the necessary colors in light is, however, a somewhat difficult problem.

The colors shown by pigments and dyes, therefore, depend upon the character of their absorption coefficients throughout the spectrum and upon the spectral composition of the light serving as an illuminant. If, then, the spectral character of the light reflected from the pigment, when a light of known spectral composition is the illuminant, is known, together with the spectral character of any other light serving as an illuminant, the apparent color of the pigment when subjected to this light can be foretold with reasonable accuracy.

But in studying pigments in this way it must be remembered that, owing to the manner in which light is absorbed by them, the method of application and mixing and the floating medium employed (oil, turpentine or water) will have an important bearing upon the result. A surface film of hardened oil reflects directly some of the incident light. On the other hand, the less the difference between the index of refractions of the light-transmitting media, the less incident light will be reflected at the plane of separation of two such media. Owing to this effect, a pigment flowed in oil shows a much more saturated hue than the same pigment flowed in water. Dyed materials in which the fibers do not have, like silk, a glossy surface permit the light to penetrate deeply with little, if any, surface reflection, and when the fabric is itself colorless the color of the material is practically the same as the color by transmission of the corresponding dye solution, only less luminous.

Such data as are given in Uhler & Woods' or C. E. K. Mees' "Atlas of Absorption Spectra" will furnish much valuable information and make it possible to form a fairly accurate judgment of the probably apparent color of the material when illuminated by light of a determined spectral distribution. The judgment must, however, be checked by the use of some such device as the color booth hereinbefore mentioned.

The fifth and concluding section of this article will deal especially with color filters.

Points to Remember When Selecting Fixtures for Gas-Filled Tungsten Lamps

Nine desirable features which fixtures for gas-filled tungsten lamps should possess were pointed out by Mr. Thomas Crawford, of Clinton, Ia., in a paper read before the Iowa Section of the National Electric Light Association recently. For example, copper cotter pins and screws are preferable since they can be removed from the other parts without being broken, as is likely with brass or steel pins. Exposed parts should be galvanized to prevent corrosion and to increase the life of the hood. The interior socket parts should be made of copper to increase the life and efficiency of the socket. The reflector should be at least 1 in. from the lamp, as too much glass near the lamp will decrease the latter's life. Proper ventilation of the hood and reflector is essential. Wires leading to the lamp socket from the outside should be arranged so that the wires may be easily disconnected for testing and for replacing. Enameled steel or wrought iron—plain, not fluted—should be used in the reflector, Mr. Crawford holds, for enamel on a fluted surface is likely to crack owing to expansion and contraction under extreme weather conditions. Both the bottom of the reflector and the bottom of the lamp should be carefully protected by bug screens. The cut-out should be of a type which is both easily replaceable and certain in operation.

Five or six different types of hoods have been tried at Clinton, said Mr. Crawford, in an effort to locate the defects in each and to suggest changes which will produce a perfect unit, and it is expected that from among the number in service a hood will be selected which will fulfill all of the foregoing requirements.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Compounding Transformers.—L. DREYFUS.—In shunt motors it is often desirable to compound the field excitation; that is, to superimpose upon the constant shunt excitation of the main field an excitation proportional to the load. With direct-current machines this is accomplished by use of two exciting windings—the shunt winding and the main current winding—on the same pole. With alternating-current commutator-type motors this arrangement would be ineffective since a winding connected to a constant alternating-current electromotive force acts like the primary winding of a transformer, producing simply a flux fluctuation. It would therefore be necessary to place the main-current winding and the shunt winding upon separate poles in order to obtain the same result for an alternating-current motor as for a direct-current motor. This arrangement has been tried in practice, but another method appears to be preferable, that is, to use a single excitation winding which is fed from a source of constant electromotive force with the intermediary of a compounding transformer. The author gives the mathematical theory of this arrangement, and also develops the diagram and the fundamental equation of the compounding transformer and shows how to dimension it.—*Elek. u. Masch.* (Vienna), May 16, 1915.

Lamps and Lighting

Electric Lighting.—F. HAMES.—A review of the present status of electric lighting. For direct current the half-watt lamp competes successfully with the best arc lamps, without being essentially superior. With alternating current the half-watt lamp is superior. However, the arc lamp may yet be improved, the author thinks.—*L'Industrie Elec.*, June 25, 1915.

Half-Watt Lamps in Germany.—An advertisement of the Siemens-Schuckert company on its new "Wotan lamps G," in which the filament is placed in "an inert gas," states that the following sizes of lamps are now available:

Volts	Watts	Mean Spherical Candle-Power	Candle-Power Along Axis
100–130	40	45	55
	60	70	85
	75	90	110
	100	130	160
200–250	75	80	100
	100	110	140

The candle-powers given in this table are hefner candles (1 hefner candle equals 0.88 British candle-power). The globes are spherical, the diameter varying between 60 mm. and 90 mm. (2⅜ in. and 3⅝ in.) for the 100-volt to 130-volt lamps and between 75 mm. and 90 mm. (3 in. and 3⅝ in.) for the 200-volt to 250-volt lamps. The corresponding lengths of the lamps vary from 120 mm. to 180 mm. (4¾ in. to 7⅛ in.), and 150 mm. and 180 mm. (5⅞ in. and 7⅛ in.) respectively.—*Elek. Zeit.*, June 24, 1915.

Generation, Transmission and Distribution

Three-Phase Motors for Repair-Dock Service.—A description of the motors used for operating the exhaust pumps on the repair docks at Venice and Taranto. One of the essential particulars of these motors, which have a rating of 750 hp. when running at 305 r.p.m., is a special arrangement by which the motor is automatically completely inclosed as soon as it ceases to operate, and is kept so inclosed during the periods of rest, which may sometimes be very long and during which the humidity of the atmosphere might damage the windings. Another particular is the vertical arrangement of the axis of the motors, the upper bearings supporting all the weight of the turning parts of motor, the pump and the vertical transmission spindle. Special arrangements are also provided for air circulation in the interior of the motor and for automatic lubrication of the bearings.—*Elettrotecnica*, Feb. 5, 1915.

Oil-Switch Fires.—F. MUENZINGER.—A. Weinberger has recently recommended to fill the space above the oil in oil switches with a neutral gas (nitrogen) or to have no gas or air in it at all in order to prevent explosions of mixtures of air and oil vapor. The present author doubts, however, that this method would be successful to prevent oil-switch explosions. He shows that the heat which is developed when a short-circuit is broken is not dangerous on account of its quantity but because the heat passes to gases or oil vapors and produces in them a large increase in volume. He briefly describes some experiments which he has made on the extinction of oil-switch fires by means of liquid carbonic acid.—*Elek. Zeit.*, June 10, 1915.

Traction

Mountain Railway.—An article on the electric locomotive of the Wendelstein railway. This railway has a length of 9.7 km. (6 miles), of which 5.8 km. (3½ miles) is operated on the gear-and-rack system and 3.9 km. (3¼ miles) as an adhesion road. Each locomotive weighs 17.4 tons and hauls two trailers of 18.6 tons, so that the total weight of the train is 36 tons. Each locomotive is equipped with two 100-hp. shunt motors, so that it is possible to regenerate energy in running down hill. The motors, which are equipped with commutation poles, make 600 r.p.m. for a speed of the train of 7 km. (4.2 miles) per hour; by weakening the field, the speed may be increased to 15 km. (9 miles).—From *Schweiz. Bauz.*, March 27, 1915; briefly abstracted in *Elek. u. Masch.* (Vienna), June 6, 1915.

Installations, Systems and Appliances

The Market for Electrical Energy in Italy.—G. SEMENZA.—The author discusses the future of the uses of electrical energy in Italy. The increase in the use of electricity for power purposes and lighting has been so great that there is no possibility of very large increases in future. On the other hand, water-power development has only begun, but the pace of development is now slackening owing to the limited demand of the market. It is necessary to look out for new fields to absorb both the excess of the electric energy actually on the market and that which may be produced in the future. The author bases his hopes particularly on the different services of electricity in agriculture, on the electrification of railways, and on the adoption, on a large scale, of electric heating and cooking. The electrification of railways has been started on a fair scale, but has not yet reached a decisive development, and the adoption of electrical heating and cooking is still out of the question on account of the existing tax on electrical energy. Finally, the author considers that a careful study should be made of the applications of electrical energy to chemical and metallurgical industries. In Italy coal is very expensive, and for this reason there may be a great future for the use of electric energy in metallurgy.—*Elettrotecnica*, Jan. 15, 1915.

Power-Factor as Element of Rates.—F. GHILARDI.—The author refers to a recent article of Darrieus, with whom he agrees that the formula to be adopted for the

"complex energy" (the energy which is paid for by the consumer and which includes a portion of the wattless power) should be of the form

$$P_c = EI\cos\phi + k\,EI\sin\phi$$

This appears to him more rational than the formula of Riccardo Arno:

$$P_c = \frac{1}{n}EI + \frac{n-1}{n}EI\cos\phi$$

On the other hand, the method of measurement employed by Darrieus and based on the formula

$$P_{wattless} = k\sqrt{3}(W_1 - W_2)$$

(W_1 and W_2 being the readings of the two meters connected according to the method of the two wattmeters) does not appear recommendable to the present writer. This method can give good results when the three phases are perfectly balanced, but the method fails completely for an unbalanced system, and that is the general case. The error not only affects the wattless power, but also the real power. The writer thinks it is best to use simply two meters, an ordinary one, measuring the real energy consumption, and another one which, by a special device, is made into a meter of wattless power. For this purpose it is sufficient to use a meter without iron like the Thomson meter, with the resistance in the voltmeter circuit replaced by an inductance, or to use an induction meter in which the fine wire is rendered free from self-induction as in induction-phase meters. The inconvenience of this method is that it requires two meters, but this would not seem prohibitive since this method of charging for electrical energy would probably be used only for large consumers.—*La Revue Elec.*, March 19 (published June 11), 1915.

Municipal Ownership of Berlin Electricity Works.—G. SOBERSKI.—After extended deliberations the city of Berlin has decided not to renew its contract with the Berlin Electricity Works, but to buy the existing works outright and to operate them itself. The reasons why the contract with the Berlin Electricity Works (with its close connection to the Allgemeine Elektricitäts-Gesellschaft) was not renewed, nor a new company formed in which both the city and the old company, and possibly other electrical industrial corporations, would be interested, is discussed at some length. An arrangement of purely municipal ownership was decided upon instead. The Bitterfeld lignite coal deposits, which belong to the Allgemeine Elektricitäts-Gesellschaft, and which were to be used for electricity supply by a long-distance transmission to Berlin, are to be used for a different purpose (fixation of atmospheric nitrogen).—*Elek. Kraft. u. Bahnen*, June 14, 1915.

Wires, Wiring and Conduits

Concentric Wiring.—DONALD SMEATON MUNRO.—An illustrated article on the "C. T. S. I." concentric system of wiring. This differs from familiar concentric cables,

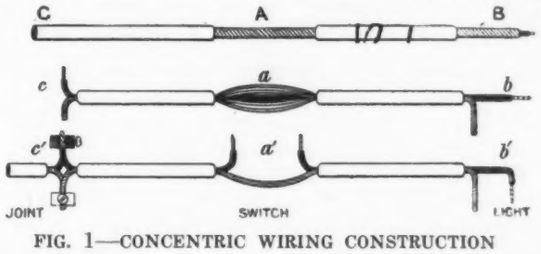


FIG. 1—CONCENTRIC WIRING CONSTRUCTION

as used for indoor wiring, in that the spiral external conductor is both insulated and protected by a special covering. A branch-circuit cable, for example, has generally a tinned-copper core which is highly insulated with pure and vulcanized rubber and is then lapped with tape. The inner core just described forms the vital wire of the circuit. Lapped round the foregoing is the external conductor. It consists of thirty-six separate wires of tinned copper of No. 30 S. W. G. These are laid side by side to form a ribbon. They are so laid that side contact is maintained generally. The effect of this side contact between the tinned surfaces and of the long "lay" of the thirty-six strands reduces to a minimum the inductive effects and the fall of potential. This long lapping is also of much advantage to the wireman by presenting the outer conductor in a form sufficient, safe and convenient for joints and for connections to fittings of standard type. It also permits soldered joints to be made at a safe distance from the important rubber insulation, or soldered joints may be omitted and terminals may be employed instead. A braided conductor or a short-lapped conductor, however excellent for specific purposes, would not afford these conveniences of manipulation, and therefore these are excluded from the system. The external copper conductor affords a degree of armoring protection to the interior insulation. It is connected to the "neutral" supply wire and is not normally interrupted at the branch switches. Double-pole fuses control the circuit. The outer conductor is insulated, preferably, with a layer of impregnated tape. Over the tape the protection is completed by a substantial layer of cab-type sheathing. Diagrams *A*, *a* and *a'* in Fig. 1 indicate how the cable is dealt with at switches. A piece of the outer cover for a length of, say, 2 in. is removed. The tape surrounding the external strands is then unwound (*A*). The cable is held on both sides of the opening and is given a slight twist in the opposite direction to which the wires are wound. The strands will then open out like a cage (*a*), and the interior insulated wire can be cut through the center. The two cut ends are next prepared for entering the switch terminals. If the cable is now given several turns, the external strands will twist into a neat and compact copper rope (*a'*), which may under certain circumstances be covered with an insulation of pure rubber tape. The treatment of the cable at outlets and other details are also described. —London *Electrician*, July 2, 1915.

Electrophysics and Magnetism

Ampere Molecular Currents.—A. EINSTEIN AND J. DE HAAS.—According to the electronic theory, Ampère's molecular currents, which are conceived to produce the magnetic properties of paramagnetic and ferromagnetic molecules, consist of evolving electrons. On this hypothesis, the paramagnetic molecule should therefore have the properties of a gyroscope. A theoretical deduction from this is that when an iron rod is reversed in its magnetism, it should be caused to rotate as though an external torque were acting, which can be predetermined theoretically. An experimental investigation which was carried out with a rod freely suspended in an alternating magnetic field confirmed the theory in qualitative as well as quantitative respects.—From *Verh. d. Deutsch. Phys. Ges.*, May, 1915; abstracted in *Elek. Zeit.*, June 17, 1915.

Tension.—C. RICHTER.—A highly theoretical article on the exact definition of tension at terminals (Klenmenspannung) and impressed tension (aufgedrückte Spannung).—*Elek. u. Masch.* (Vienna), May 30, 1915.

Electrochemistry and Batteries

Manufacture of Sodium Nitrate in Electric Furnace. —A new hydroelectric plant is to be built at Laroquebrou, France, for the manufacture of sodium nitrate by the electric-furnace method, a dam having been built across the Cere River to give a head of 488 ft. Artificial nitrates may also be made at Bouvillard, near Aiquebelle (Savoie), with power from the Arc at La Chambre.

At Venissieux, near Lyons, the Electrode company carries on the manufacture of large quantities of electrodes, its output in 1913 having been over 5000 tons. The Société Générale des Nitrures at present makes no nitrides at its works at St. Jean de Maurienne, but arrangements are said to have been made with a Norwegian firm for importing them into France. Another company is perfecting a rival process, invented by Coutagne.—London *Engineer*, July 30, 1915.

Units, Measurements and Instruments

British National Physical Laboratory.—The conclusion of the recent annual report. In the present installment the proposed work of the physical department is described, referring to absolute measurements of resistance, wire-resistance standards, standard cells, international comparison of standards, magnetographs, self-inductance and mutual induction measurements, measuring of high-frequency currents, and magnet steel. The proposed work in the electrotechnical department refers to the unit of light, new water-tube resistances, a new three-phase switch for operating the electrostatic wattmeter on three-phase currents up to 20,000 volts, the heating of buried cables, the temperature scale, expansion coefficients of metals and alloys, and the thermal conductivity of refractory materials.—London *Electrician*, July 2, 1915.

Telegraphy, Telephony and Signals

Wireless-Telegraphy Antenna for Long Waves.—Bethenod proposes the antenna arrangement shown in Fig. 2, in which the antenna starts from the station

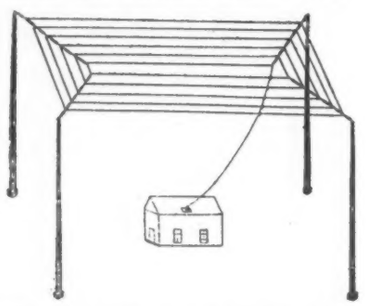


FIG. 2—SPIRAL ANTENNA FOR GREAT WAVE-LENGTHS

building in the form of a single wire and is then arranged in form of a spiral in a nearly horizontal plane by means of supporting cables as shown in the illustration. Fig. 3 shows an ordinary antenna consisting of eleven wires, the wave-lengths being 3500 meters, in comparison with an antenna in which the spiral arrangement is used, the wave-length being 5500 meters. As will be seen, the construction is much simpler and

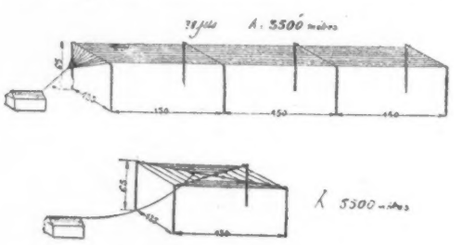


FIG. 3—COMPARATIVE DIMENSIONS OF A SPIRAL AND AN ORDINARY ANTENNA

requires much less space. The only inconvenience seems to be that a spiral antenna cannot be used with damped waves on account of the high tension which would be developed between the horizontal conductors.—*La Revue Elec.*, March 5 (published May 28), 1915.

Book Reviews

MODERN ILLUMINANTS AND ILLUMINATING ENGINEERING. By Leon Gaster and J. S. Dow. New York: The Macmillan Company. 462 pages, 204 illus. Price, $5.

In this book there is presented a general treatise on the subjects indicated by its title. Its British authorship is apparent in its general viewpoint and in its numerous references to British technical literature, which fact makes it all the more valuable for the American reader who wishes to broaden his view. The variety of subjects covered is so large that the authors have necessarily omitted detailed treatment of many subjects and in some of the most important particulars have referred the reader to other literature. However, taken altogether, the book probably constitutes the most complete treatise on the subject that has yet appeared in one pair of covers. The preparation of a book of this kind is a matter of judgment in selection from the large amount of available material. The judgment of the authors in this case has usually been well balanced. The first part of the book is devoted to the history of illumination and illuminants. The effect of light on the eye justly receives considerable attention. The measurement of light and illumination and a description of a number of the more common photometers occupy sixty-five pages. The principles of globes, shades and reflectors are well set forth and the calculation of illumination is rather briefly handled under this head. About one-third of the book is given to an excellent discussion of problems of interior and exterior illumination. The point of view of the authors in this and in other portions of the book is that of discussion and criticism rather than the presentation of concise data of the engineering handbook type.

CONSERVATION OF WATER BY STORAGE. By George F. Swain. New Haven: Yale University Press. 384 pages, 91 illus. Price, $3.

This book is composed of a series of lectures delivered in the Chester S. Lyman Lecture Series of 1914 before the Sheffield Scientific School of Yale University. The author of the series discusses in considerable detail the general subject of conservation of water, considering both the legal and technical aspects. In the first chapter an outline of the situation which now confronts the people of this country is given, extensive use being made of the report of the National Conservation Committee. The following chapters are devoted to the relation of water to other resources and to the controversies which have been waged in Congress and out with reference to the questions of federal control of water-power at government dams, at private dams and on public domain. In these chapters a wealth of legal data on the subject is given. A chapter is also devoted to the technical aspects of the subject of the conservation of water, the variability of the water supply and the effect upon navigation, as well as the factors to be considered in the design of dams, power houses, etc. Another chapter deals with the relation between forests and stream flow, emphasis being laid on the fact that water may be stored in the ground as well as in open reservoirs. In this chapter efforts have been made to discuss the general principles involved and the general methods of investigation, the author feeling that there is considerable misapprehension even among scientists and engineers on the subject. The last chapter deals with floods and their prevention, an appendix giving legal data on the water-power situation being included. The book should prove of especial value to those interested in the legal aspects of the situation.

POWER AND OPERATING SECTION

A Method of Softening and Purifying Feed Water Used by a Brooklyn Company

At the Gold Street station of the Edison Electric Illuminating Company of Brooklyn a method of softening and purifying boiler-feed water is used which employs a special mineral substance to remove iron, calcium and magnesium. The effectiveness of this method in the treatment of 250,000 gal. of water every twenty-four hours for over a year is shown in Table I by the

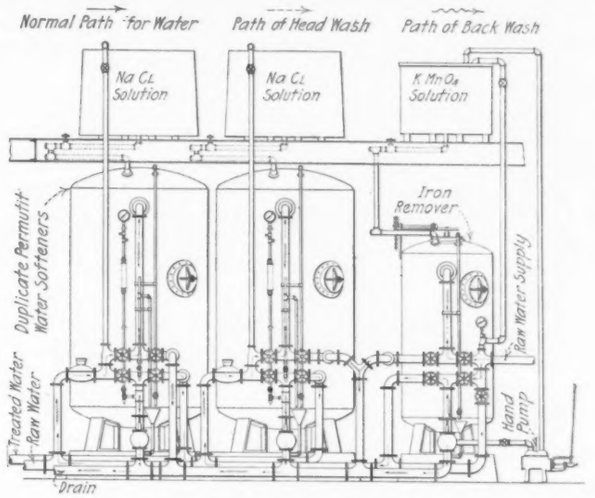


FIG. 1—ARRANGEMENT OF WATER SOFTENING AND PURIFYING TANKS

analysis of the water before and after treatment made in the company's laboratory.

The layout of the apparatus used is shown in Fig. 1 and consists of three tanks with a filling and inside arrangement similar to a sand filter but with a layer of a special porous mineral substance known as "permutit" and possessing the property of exchanging its chemical base for another, used instead of sand. "Permutit" is made by fusing together feldspar, kaolin, pearlash and soda in definite proportions.

One of the three tanks shown in Fig. 1 contains "manganese permutit" and the other two "sodium permutit." The raw water is delivered to the first tank, where the iron is eliminated. It then flows into one of the other tanks, where calcium and magnesium, the elements which make up scale-forming compounds, are replaced by sodium, all of whose compounds are soluble and non-scale-forming. About the only difference between the iron remover and the duplicate tanks, except for size, is the material they contain. A cross-section of one of the calcium and magnesium removers is shown in Fig. 2. At the top is a perforated tray containing gravel or crushed marble. Below this is an open space and then a layer of "sodium permutit" resting on a bed of gravel, which in turn is supported on another perforated platform. A pipe connecting with the upper part of the tank delivers the raw water on top of the crushed marble, which removes any acid in the water and distributes it evenly over the "sodium permutit" below. Both of the duplicate tanks are designed to perform the same operation, but since each can be used at full rating of 125,000 gal. only twelve hours at a time, one unit is backwashed and regenerated while the other is operating.

Regeneration is necessary as the "permutit" becomes saturated and inactive after about 125,000 gal. of water has passed through it. Raw water is flushed up through the gravel and "permutit" to loosen and wash it in the regeneration process, the gravel at the top of the tank preventing the "permutit" being carried out through the overflow. After this back-wash, a 10 per cent solution of salt is used. Owing to its concentration the NaCl reverses the former action, converting the calcium and magnesium "permutit" to "sodium permutit," which is required for softening the water. This conversion requires about ten hours, after which the solution is drained into the sump and a head-wash of fresh water is forced through the tank to remove all of the regenerating solution. Aside from the washing and regeneration, there is no expense in operating the softeners as practically no attention is required. The "permutit" is long-lived, a renewal amount of not more than 3 to 5 per cent being required per year.

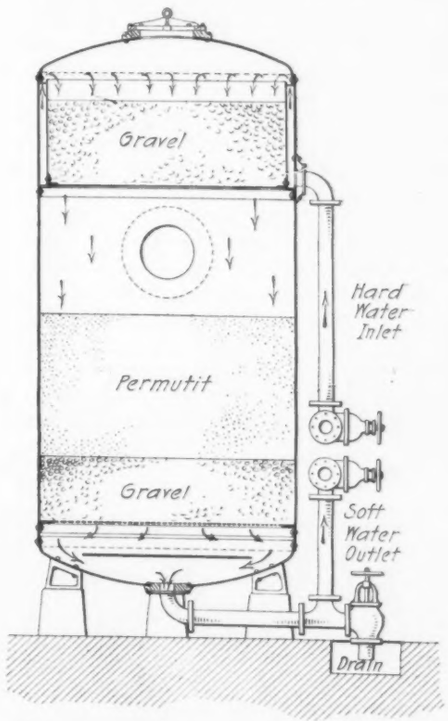


FIG. 2—ARRANGEMENT OF FILLING IN TANK FOR REMOVING CALCIUM AND MAGNESIUM FROM WATER

The iron remover already mentioned is similar to the water softeners, the only difference being that the manganese compound is used instead of the sodium compound. The iron is separated by oxidation and deposited on the "permutit" as a sludge. The iron-removing tank can be operated continuously three or four weeks without revivifying. This is done by back-washing, and saturating the exhausted "permutit" with a 2 per cent solution of potassium permanganate ($KMnO_4$),

pumping the regenerating solution back into a storage tank, and then head-washing. The process of recharging takes about one hour. The potassium permanganate can be used over and over again by periodically adding fresh to make up for wastage.

ANALYSIS OF MAKE-UP WATER FOR BROOKLYN PLANT

Constituents	Parts per Million	
	Before Treatment	After Treatment
Silica (SiO_2)	8.9	9.5
Iron oxide (Fe_2O_3)	1.0	0.0
Aluminum oxide (Al_2O_3)	0.6	0.6
Lime (CaO)	14.0	Trace
Magnesia (MgO)	5.8	Trace
Alkalis as (Na)	16.8	37.2
Sulphuric anhydride (SO_3)	10.8	9.6
Chlorine (Cl)	22.0	24.0
Alkalinity	14.0	17.0

The equipment and substance used therein are manufactured by the Permutit Company, 30 East Forty-second Street, New York City.

Alternating-Current Switchboard Costs

BY J. WILMORE

The self-contained switchboard, as distinguished from the remote-control and electric-operated types, has been found in practice to be the most desirable for three-phase alternating-current plants of a rating up to and not exceeding 3000 kva. and a potential of 2500 volts or less. Modern power-station practice has practically standardized the switchboard equipment, and the large manufacturers now carry a line of various panels which are known as "standard units." By choosing from these stock units, a complete switchboard for any installation may be easily made up.

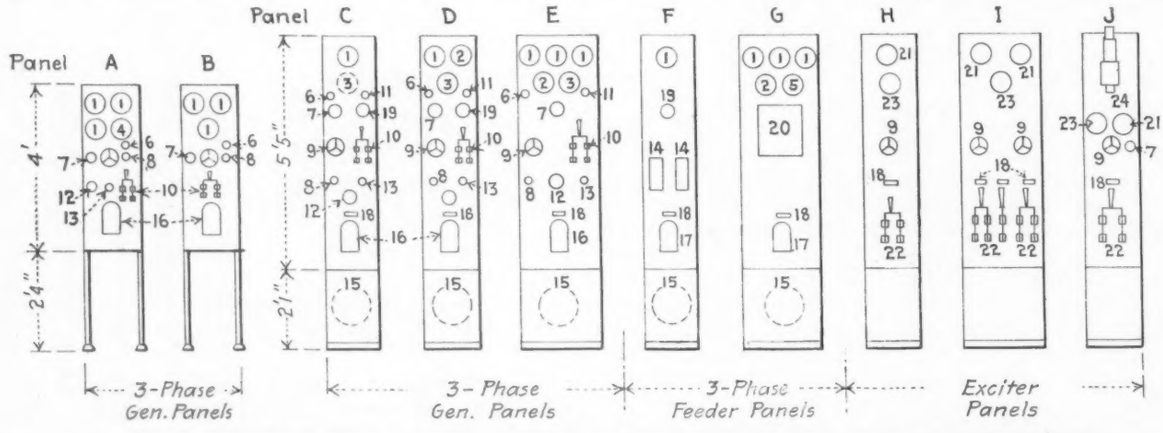
These panels are usually made of black marine or natural black slate, mounted on angle iron or pipe frames, being 90 in. high with two or three sections of slate covering the entire frame from top to floor, or 76 in. high for the smaller and lighter panels, with one section of slate 48 in. high and the exposed frame extending to the floor.

The 90-in. panels in two sections are made up of either a 65-in. top section and 25-in. lower section or 62-in. and 28-in. sections respectively. A 90-in. panel in three sections has a 20-in. upper section, 45-in. middle and 25-in. lower section, or 28-in., 31-in. and 31-in. sections respectively. These sections are 24 in., 20 in. or 16 in. wide. The thickness of slate is usually 1.5 in.

The following cost data, which may be used for estimating or for purposes of comparison, are based on figures recently published in a series of papers by C. H. Sanderson and H. A. Travers. The values given are for three-phase, 2200-volt panels completely wired, corresponding to the ratings listed in the tabulations covering the various switchboard panels shown in the illustrations. These panels represent a form of standard units and are typical of self-contained switchboards.

RATINGS AND COST OF SWITCHBOARD PANELS

Panel	Type	Rating, Kva.	Approximate Cost per Panel
Generator	A	10–200	$34
		250– 800	44
		1000–1200	52
Generator	B	10– 200	63
Generator	C	25– 500	122
		600–1200	139
		1400–2250	213
Generator	D	25– 500	175
		600– 800	180
		1000–1200	192
		1400–2250	265
Generator	E	25– 500	210
		600– 800	215
		1000–1200	228
		1400–2250	300
Feeder	F	25–1200	170
		1400–2250	215
Feeder	G	25–1200	400
		1400–2000	445
Exciter	H	4– 25	75
		35– 45	81
		55– 75	90
		150– 200	129
Exciter	I	4– 25	116
		35– 45	125
		55– 75	139
		150– 200	195
Exciter	J	4– 25	110
		35– 45	121
		55– 75	135
		150– 200	210



SWITCHBOARD PANELS WITH THE NUMBERS DESIGNATING INSTRUMENTS AND OTHER EQUIPMENT

1—Alternating-current ammeter.
2—Indicating wattmeter.
3—Field ammeter.
4—Alternating-current voltmeter.
5—Power-factor meter.
6—Synchronizing lamp.
7—Voltmeter receptacle.
8—Synchronizing receptacle.
9—Rheostat.
10—Field discharge switch.
11—Ground detector lamp.
12—Ground detector receptacle.
13—Ground detector push.
14—Single-phase relay.
15—Recording watt-hour meter.
16—Non-automatic oil switch.
17—Automatic oil circuit-breaker.
18—Card holder.
19—Ammeter receptacle.
20—Graphic recording wattmeter.
21—Direct-current ammeter.
22—Knife switch.
23—Direct-current voltmeter.
24—Carbon breaker (shunt trip and reverse current relay.)

A Case Where Motor Drive Just Suits

An interesting motor load secured by the Louisville (Ky.) Gas & Electric Company on the basis of the economy of motor drive is shown in the accompanying illustration of a shoddy mill operated by H. Davis & Company of Louisville, Ky. This particular industry is sensitive to general business conditions and especially

ONE OF THREE MOTOR DRIVES IN A LOUISVILLE (KY.) SHODDY MILL

to fluctuations in the cotton market, so that operating costs are an important item, to be kept as low as possible.

Three mills similar to the one shown are operated in the Davis plant, each driven by a 35-hp. General Electric induction motor. The motors operate at 1150 r.p.m. and are belted direct to the pulleys on the cylinders of the machines, which run at about 1000 r.p.m. Each machine has a capacity of 250 lb. per hour, and economical operation depends on the proper feeding and operation of each machine as near its full capacity as possible at all times. The advantage of having three distinct units each with its individual motor is in keeping the energy consumption per 100 lb. of product practically uniform even with a wide range of production.

ENERGY CONSUMPTION OF THREE SHODDY MILLS

Year	Month	Kilowatt-Hours Used
1914	January	7,220
	February	5,850
	March	4,290
	April	6,460
	May	8,050
	June	10,790
	July	10,840
	August	9,720
	September	9,110
	October	10,800
	November	3,880
	December	4,230
1915	January	.....
	February	2,420
	March	3,790
	April	6,090
	May	5,110
	June	9,230
	July	10,770

The raw material used in this plant is composed of tailor's trimmings. These are threshed by the mills into a fluffy mass and pressed into bales of about 500 lb. each, for use for the most part by mattress manufacturers. There is considerable danger of fire in operating this machine, which hazard is taken care of by the installation of the fire hose at the back of the operator.

The energy consumption in the Davis plant for each month since January, 1914, is given in the accompanying table, and varies from approximately 7 kw.-hr. to 9 kw.-hr. per 100 lb. of finished product, depending upon the kind of material. The average for the period given is about 8 kw.-hr. per 100 lb. The load-factor during running time averages about 45 per cent, and has been increased at times to 60 per cent during a single day's operation of the Davis plant.

A Convenient Meter Installation Runabout and Cost of Its Operation

BY H. A. HIPPLER

The El Paso (Tex.) Electric Railway Company uses a Ford runabout to facilitate the work of its meter installation department. The vehicle has been adapted to this use in the company's shops at a small cost by removing the rear tool chest supplied with the machine and replacing this with the body and running-board boxes shown in the accompanying illustration. The body measures 2½ ft. by 4 ft. and is 8 in. deep, and a heavy mattress covers the bottom. The body itself is divided into sections by removable partitions so that twenty house meters may be carried. These partitions are just large enough for one meter and are lined with felt to prevent being scratched in transportation. The meters are carried upright as shown, and the combination of pneumatic tires and heavy mattress effectively eliminates any jarring and trouble tending to affect their calibration.

On the left side of the machine a short step-ladder is carried in brackets, and the box on the running board is supplied with the necessary automobile tools and repair parts. Space is available in the box on the right running board to carry two empty meter cartons containing seventy-five lamps of various sizes. In the illustration one of these cartons is shown on top of the box. Space is also available in this box to carry a supply of fuses and wire for splicing meter loops. When more lamps are needed they are carried in empty cartons

A LIGHT VEHICLE ADAPTED FOR CONVENIENT USE OF METER-INSTALLING CREW

which may be placed between the engine hood and the fenders.

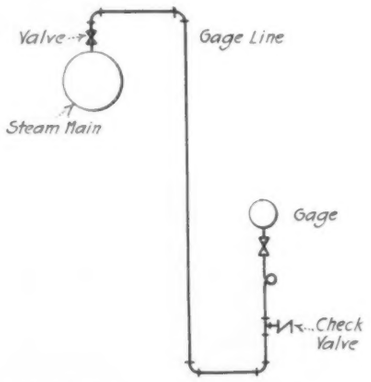
The machine has been in service nearly a year, and an accurate record of its performance fully proves the adaptability of this light-weight, low-priced vehicle for work of this nature. The crew consists of an installer and the driver, who assists the installer whenever possible. During the eleven months the machine has been in operation it has covered a distance of 8900 miles and handled approximately 7000 orders. An ordinary day's work has called for fifty-two stops and the covering of about 29 miles. Of these fifty-two stops, twenty-three represented meters "cut in," ten meters "cut out," six meters "transferred," and the remainder miscellaneous stops.

Up to date $249.50 has been spent on the machine, including gasoline and lubricants, tires and inner tubes, repairs due to two minor accidents, a general overhauling and painting (in the company's shops), and a new speedometer. This shows an average mileage charge of less than 3 cents, and the machine is still in splendid condition.

A survey of the records also shows that the engine averaged as low as 12.4 miles per gallon of gasoline during cold weather when the vehicle had run nearly 6000 miles without being overhauled. During hot weather and after it had been overhauled the records show 21.7 miles per gallon of gasoline. Considering the salaries of the two men who use this runabout and the cost of gasoline and lubricating oils, the cost per stop closely approximates 15 cents.

Check Valve Used to Protect a Steam Gage and Prevent Indicating Errors

When steam is cut off a main section of piping in a plant to make repairs, or for any other reason, the resulting condensation in the main will form a vacuum, and the gage will read below zero, indicating the actual amount of vacuum if it happens to be a compound steam and vacuum gage. If the gage registers pressure only, it will not record below zero, as the indicator is stopped



POSITION FOR CHECK VALVE IN LINE TO A STEAM GAGE

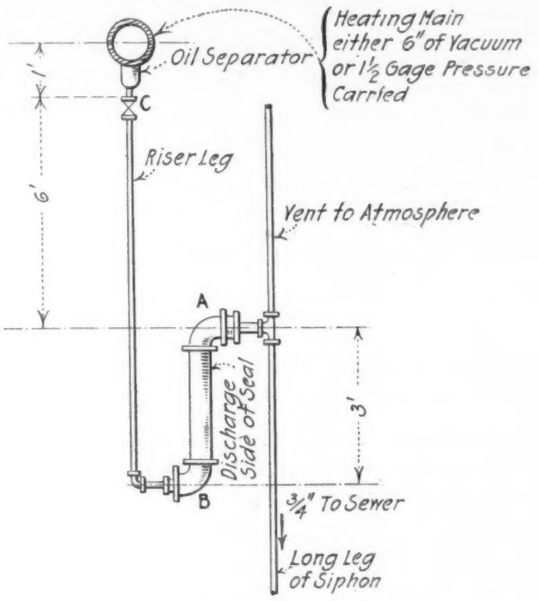
at that point on the scale by the usual small peg attached to the gage. This condition may throw the gage mechanism out of adjustment.

A simple arrangement to prevent this trouble is shown in the accompanying diagram. The small check valve open to the atmosphere and shown connected to a T in the gage line will remain closed when pressure is on the main, but will automatically open and admit air to break the vacuum at the gage when the pressure is off the main. The cock at the gage could be closed when a vacuum exists in the main, but it does not possess the automatic feature which is obtained by the use of a check valve. When the distance between the main and the gage is considerable, an ordinary stop valve as a precautionary measure should always be installed on the gage line where the tap into the main is made. This stop valve may also be used for the purpose of shutting off steam to the gage.

Reasons for an Oil Separator Failing to Work

By T. W. Reynolds

The piping arrangement shown in the accompanying diagram was used in connection with an oil separator of a heating main in which there was alternately a pressure above atmosphere and a pressure below. The heating main when operated under a partial vacuum induced the return of oil from the separator upward and into the heating system. In mild weather, to prevent overheating of the rooms, only 6 in. of vacuum, or about 3 lb. pressure below atmosphere, was carried



PIPE SIZES AND ARRANGEMENT THAT MADE AN OIL SEPARATOR WORK

on the heating main. At other times and in severe weather this was changed to 1½ lb. gage pressure.

Starting with a steam pressure of 1½ lb., the oil would stand in the seal from point *B* to point *A*, and would immediately siphon to the sewer if it were not for the vent to the atmosphere, which would break the siphon. For this condition there was only a head of 3 ft. in the pipe, and when the system was changed to operate with less than 6 in. of vacuum, there would be available only this 3 ft. of head to resist the suction of 3 lb. For this reason the pipe forming the discharge side of the seal was increased in size to 2½ in. in order to supply a volume sufficient to form a 6-ft. head in the riser leg above the crest of the siphon, with an additional 3-ft. head in both sides of the seal, each balancing the other.

With this arrangement it was found that the oil would stand in the pipes at points *A*, *B* and *C*, and could not for the given conditions be lifted into the main, provided that there was no decrease in the distance of 6 ft. that the riser leg is above the crest of the siphon.

COMMERCIAL SECTION

A Premium Plan That Wired 250 Houses

Two Ways of Applying a Premium Offer—The Story of the Results Obtained with Customers' Help at Minneapolis

THE Minneapolis General Electric Company has developed an exceedingly interesting premium plan to assist in the closing of contracts for the wiring of old houses. The idea was first put into effect last summer and resulted in practically doubling the number of houses wired during the four summer months as compared with corresponding figures for the year before. The plan was a simple one in which the company offered a premium to every customer whose cooperation was instrumental in the securing of a house-wiring contract, the character of the premium—that is, the appliance given—being dependent upon the size of the contract secured.

The Influence of the Premium

The offer was given wide publicity through the company's newspaper advertising, and response was prompt and far more effective than had been expected. It virtually resulted in enlisting as an active selling agency the aid of countless consumers who sought every opportunity to interest their friends and acquaintances in modern applications of electric service in the home. The company did not suggest that these volunteer agents make any effort directly to secure an order or close a contract, their function being to spread the influence of their own experience and enthusiasm and to notify the company whenever, in their opinion, the way was sufficiently prepared for a call from a regular salesman representing the company.

As the sales manager of the company states: "The customers use all the arguments with which they are acquainted from personal experience to persuade prospective customers to take the company's service in order that they may themselves receive their premiums." When the contract is closed the customer who has influenced the sale receives his choice of a number of premiums, the value of which depends upon the size of the contract.

No hard and fast rules were followed in utilizing the services of these customer-salespeople, after a prospective customer was reported, but naturally the regular salesman used the name of the customer for introductory purposes. Also, where it was found that a bit of assistance could be rendered by this customer, there was no hesitation in calling for it, and in most cases the response was willing. It was expected that among the names suggested in this competition there would be a considerable number not well supported with missionary work actually done by the customer, and that there would be a certain number of improper applications for premiums, but the campaign was conspicuously free from incidents of this kind.

The First Experiment with This Selling Plan

The first premium offer went into effect on June 1, 1914, and was in force throughout the month of September. The accompanying table gives interesting figures on the number of houses wired during those months, as compared with corresponding months of the year before. From the beginning of the year to the first of June, it will be noted, there was an increase of 23 per cent in the number of old houses wired over the same period in the previous year. This is taken as the natural increase, which would have been expected if no additional effort had been made to interest this class of business. Since other conditions were the same as during the previous year, the company believes all increase over 23 per cent effected during the campaign to be due to this premium offer entirely. The total gain over the four months' period figured 71 per cent, or more than 250 houses wired, which, by the way, is between two and three houses wired per working day as the result of premiums.

In commenting on the campaign, the sales manager writes: "We, of course, have no actual, direct proof that a customer received in this way will in turn secure a premium for himself by giving us the name of another 'prospect' who will become a customer, but there is little doubt in my mind that this system has a wonderfully cumulative effect. The greater number of the applications are from women, and I will say that they make very good missionaries—these women customers of ours working for premiums."

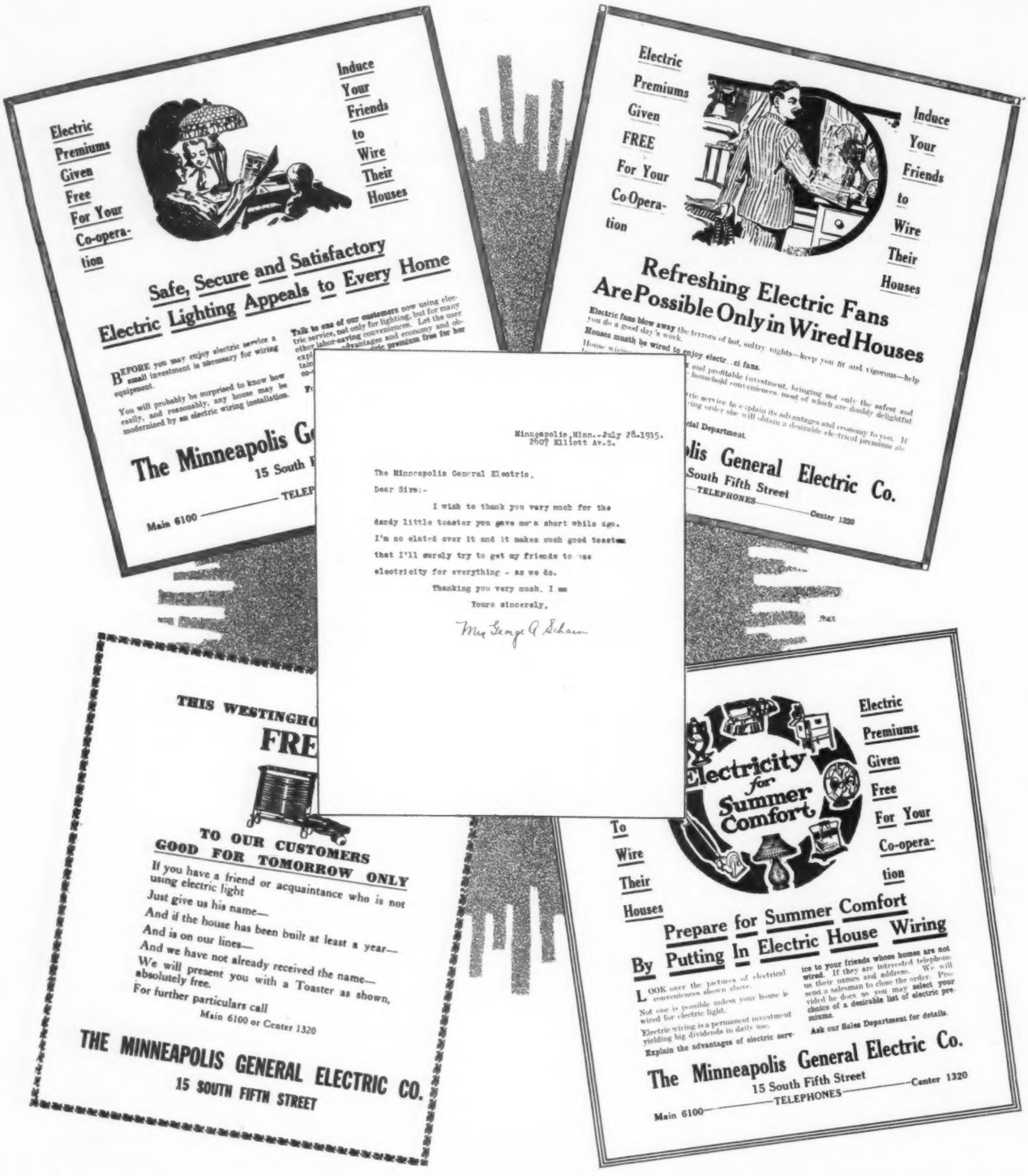
TABLE SHOWING COMPARATIVE NUMBER OF OLD HOUSES WIRED DURING CORRESPONDING MONTHS OF 1913-1914

Month	Old Houses Wired, 1913	Old Houses Wired, 1914	Percentage of Increase
January 1–May 28	359	442	23
June	104	153	47
July	92	149	62
August	82	150	63
September	75	233	210
Total for campaign period	353	685	94

Offering Premiums for "Prospects" Only

A further application of the premium plan has just been successfully made in Minneapolis through a one-day premium campaign. In this instance a toaster was offered to any customer who would send the company the name of an acquaintance or a friend at that time living in an unwired house which had been built for at least one year and, of course, situated along the company's lines, provided only that this name had not already been contributed by another customer. This offer did not entail any missionary work on the part of the customer, and it was not necessary for him to await the outcome of the company's own selling effort before the prize was given. In this one-day campaign all that was required of the customer was to present the name of a qualified

"prospect" for house wiring, and the toaster was freely given. About 300 toasters were issued on this day, and the names of more than 1000 "prospects" were received.

Most of the contestants supplied more than one name, some of them offering as many as fifteen or twenty names, to make sure that they were complying with all find out how many contracts out of the number will be closed; but the benefits which have already been derived, together with results in view, satisfy the company that the offer was entirely profitable. The toasters which were given away were some which cost only about $1 each. They had been left over from a campaign which

Electric Premiums Given Free For Your Co-operation
Induce Your Friends to Wire Their Houses
Safe, Secure and Satisfactory
Electric Lighting Appeals to Every Home
BEFORE you may enjoy electric service a small investment is necessary for wiring equipment.
You will probably be surprised to know how easily, and reasonably, any house may be modernized by an electric wiring installation.
Talk to one of our customers now using electric service, not only for lighting, but for many other labor-saving conveniences. Let the user explain the advantages and economy and obtain one premium free for her co-
The Minneapolis G
15 South
Main 6100 TELEP
Electric Premiums Given FREE For Your Co-Operation
Induce Your Friends to Wire Their Houses
Refreshing Electric Fans
Are Possible Only in Wired Houses
Electric fans blow away the terrors of hot, sultry nights—keep you fit and vigorous—help you do a good day's work.
Houses must be wired to enjoy electric fans.
and profitable investment, bringing not only the safest and household conveniences most of which are doubly delightful
tric service to explain its advantages and economy to you. If ing order she will obtain a desirable electrical premium al
dial Department.
lis General Electric Co.
South Fifth Street
TELEPHONES Center 1320
Minneapolis, Minn.-July 28-1915.
2607 Elliott Av.S.
The Minneapolis General Electric,
Dear Sirs:-
I wish to thank you very much for the dandy little toaster you gave me a short while ago. I'm so elated over it and it makes such good toast that I'll surely try to get my friends to use electricity for everything - as we do.
Thanking you very much, I am
Yours sincerely,
Mrs George A Schaan
THIS WESTINGHO
FRE
TO OUR CUSTOMERS
GOOD FOR TOMORROW ONLY
If you have a friend or acquaintance who is not using electric light
Just give us his name—
And if the house has been built at least a year—
And is on our lines—
And we have not already received the name—
We will present you with a Toaster as shown, absolutely free.
For further particulars call
Main 6100 or Center 1320
THE MINNEAPOLIS GENERAL ELECTRIC CO.
15 SOUTH FIFTH STREET
Electricity for Summer Comfort
Electric Premiums Given Free For Your Co-operation
To Wire Their Houses
Prepare for Summer Comfort
By Putting In Electric House Wiring
LOOK over the pictures of electrical conveniences shown above.
Not one is possible unless your home is wired for electric light.
Electric wiring is a permanent investment yielding big dividends in daily use.
Explain the advantages of electric service to your friends whose homes are not wired. If they are interested telephone us their names and address. We will send a salesman to close the order. Provided he does so you may select your choice of a desirable list of electric premiums.
Ask our Sales Department for details.
The Minneapolis General Electric Co.
15 South Fifth Street
Main 6100 TELEPHONES Center 1320

THESE FOUR DISPLAY ADVERTISEMENTS WERE THE ONLY "ADS" USED IN PROMOTING THE PREMIUM CAMPAIGNS. IN THE CENTER APPEARS A TESTIMONIAL FROM ONE OF THE CONTESTANTS IN THE ONE-DAY CAMPAIGN

the conditions. Many gave a few names over the telephone and stated that they would follow this in the mail with a longer list, which they did—lists coming in for several days thereafter. Not enough time has elapsed for sufficiently working over this list of "prospects" to was conducted during the Christmas holidays, and, as a matter of fact, the company had been seriously wondering how it was going to get rid of this particular lot of toasters.

The sales manager of the company writes: "The 1000

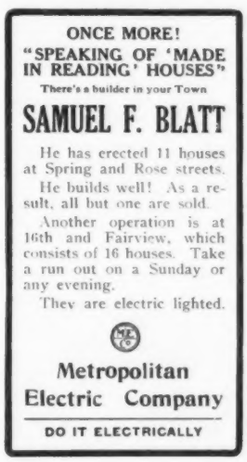
names of 'prospects,' of course, afforded us a valuable mailing list as well as a list for the salesmen to work on, but not least in importance is the fact that the 300 successful applicants provide a corps of 300 'live' salesmen, or rather saleswomen, as virtually every applicant was a woman. The fact that these 300 persons obtained premiums is evidence that they were 'live wires,' and we are making good use of them.

"Another very surprising fact in connection with the applicants for premiums was the class of people who applied. Of course, everyone wants something for nothing, and this is not limited by any means to the poorer class. We found that the better-off class of people are just as desirous of getting something for nothing. The great majority of applicants were from among the more intelligent and prosperous class, many of them being well-to-do people."

The experience in Minneapolis is an interesting evidence of the worth of any artifice that serves to win the attentive interest of present customers. No one can do so much for the public-service company as the consumer who will spread enthusiastic testimonials, and if this invaluable co-operation can be invoked by the bestowal of inexpensive toasters, here is an opportunity that every central station might well take advantage of. For every toaster given away will soon pay back its cost in additional energy consumption.

Co-operating with Builders

The accompanying advertisement, which the Metropolitan Electric Company ran in the Reading (Pa.) papers, should suggest volumes to an alert central-station management. Practically the entire real-estate


ONCE MORE!
"SPEAKING OF 'MADE IN READING' HOUSES"
There's a builder in your Town
SAMUEL F. BLATT
He has erected 11 houses at Spring and Rose streets.
He builds well! As a result, all but one are sold.
Another operation is at 16th and Fairview, which consists of 16 houses. Take a run out on a Sunday or any evening.
They are electric lighted.
Metropolitan
Electric Company
DO IT ELECTRICALLY

"IF IT ISN'T WIRED, IT ISN'T MODERN"

field is at the industry's disposal as an advertising medium. The Metropolitan company goes even further and supplies builders with "For Sale" and "To Let" cards. The name of the owner is printed in black and across the card in red are the words "Wired for Electricity." The following letter was received by the company from one builder, showing that the builders appreciate the fact that houses wired for electricity are good sellers:

"GENTLEMEN:—As a builder of homes intended for the workingman, I am glad to say that since I have introduced the plan of wiring all houses built by me for electricity I find there is a popular demand. Reading has been peculiar in the fact that not many houses were wired up to within a year ago. People coming from out of town have been accustomed to the use of electricity and of course demand it when they locate in Reading. Hence the demand for electricity. Wiring houses for electricity is nothing more or less than a business proposition for me—I cater to the demands of the public."

The real-estate man is a potential opportunity of no mean value, and the central-station manager can well afford to expend the time and effort necessary to enlist his active co-operation. The Reading company points one way to start the good work by devoting a small part of its advertising space to the service of the local real-estate agents, while at the same time featuring in the same advertisement the fact that electrically lighted houses rent most easily.

Realism in a Hot-Weather Window Display

In the show window of the Western Electric Company at Cincinnati, Ohio, a bushel of white paper confetti, a thermometer and a few fans were used recently to make a most realistic snowstorm scene. The fans were so placed as to create a continuous current of air in the window, which kept the "snow" in constant motion, eddying, rising, falling, and whirling about in the inclosed space. A sign displayed read, "Remember this when the weather is warm." To add the last touch of realism to the scene a large thermometer, previously drained of part of its mercury column, was placed in the foreground. Many observers, noting the low temperature indicated by this instrument, placed their hands against the glass to see if it was really cold.

Electric Sewing Machines for Hotel Mending

At the Hotel Lyons, a 15-cent lodging house in Brooklyn, N. Y., an electric sewing machine is being used for making and repairing towels and linen for about 300 beds. According to reports about 150 per cent more work is now being done than with the old foot-power machines formerly used. As a result the sewing and mending does not "get behind," and only one repairman is required. The sewing-machine motor is operated eight hours a day, making about 450 towels as compared with 275 by foot power. In addition, bed linen and mattress covers are repaired by the machine.

ELECTRIC SEWING MACHINE IN BROOKLYN LODGING HOUSE

Eliminating Fumes with Electricity

The Duquesne Reduction Company, Pittsburgh, Pa., employs a high-voltage discharge to remove copper from the fumes emitted by its plant, and so does away with nauseous gases in the neighborhood. A 10-hp., three-phase motor drives a 160-volt direct-current generator, the output of which is stepped up to 62,500 volts by an induction coil. On the motor shaft is a rectifier switch which converts the alternating-current discharge into a unidirectional flow. The ungrounded side of the rectifier leads is run to an electrode from which the high-voltage corona discharge takes place. This discharge precipitates the copper from the fumes and causes it to fall to the bottom of a tank from which it can be removed.

What an Electric-Sign Purchaser Buys

While it is generally admitted that the customer purchasing illumination from a central-station company receives full value for his expenditure, the fact is sometimes not taken into consideration that an electric-sign customer buys not merely energy to produce light, but makes his purchase for the effect which the lighting display will produce on the passer-by.

This fact, said Mr. V. L. Blanchard, of the Toledo Railways & Light Company, before the salesmen of the Ohio Electric Light Association at Columbus, emphasizes the point that the effect to be produced by electric signs must be studied. Distinctive and carefully designed signs should be prepared for each customer so that he will receive the fullest benefit from his electrical advertising. In designing a sign for any prospective customer the thought which should be kept uppermost is that the real purpose of the sign is to help the merchant sell his product.

In the discussion of Mr. Blanchard's paper the point was brought out that much of the success of the Toledo company in selling signs has been due to the fact that it has not sold "stock signs" except in instances where the credit or stability of the purchaser was questionable. If upon default of the purchaser such signs were taken over by the company, they would not represent a loss, but with repainting could generally be resold with profit to the company.

"SUGGESTION" IS AN IMPORTANT FUNCTION OF THE ELECTRIC SIGN

In regard to time payments on sign sales, Mr. Blanchard said that the Toledo company as a rule allows the purchaser one year in which to complete his payments. On one sign, however, which cost $1,500, the merchant has been permitted to extend his payments over a period of three years.

Saving Postage on Electric-Service Bills

From $700 to $1,000 per year is saved in postage and clerical work in mailing electric-service bills at North Attleboro, Mass., where the municipal lighting department has adopted the post-card bill form reproduced herewith. The form has been approved by the postal authorities at Washington, D. C., and carries the meter readings for the current and preceding months, the total energy consumption, amount of bill and the discount of 20 per cent offered for payment on or before the 16th of the month. Mr. William Plattner is manager of the North Attleboro electric department.

The bills can be paid at the Selectmen's Room, Odd Fellows Building, on the 15th and 16th day of each month, between the hours of 12:30 and 4 p.m.

TOWN OF NORTH ATTLEBOROUGH, MASS.

Electric Current supplied for month of MAR. 1915

158 MR. GEO. E. CASSELS, WASHINGTON ST.

Pres. Reading	6258		50¢ per month will be charged where current is not used to that amount No discount on same.
Prov. Reading	6222		
Difference			
$5.40 Consumption	36	K. W. Hrs. @ 15¢	$5.40

A discount $ 1.08 if paid on or before 10th day of month following that in which current was used

$ $

$ Checks payable to North Attleborough Electric Dept. $

A SIMPLIFIED FORM OF CUSTOMER'S BILL

Bargain House-Wiring Offers at Sandusky, Ohio

Some months ago the Sandusky (Ohio) Gas & Electric Company made an offer to wire any kitchen or laundry on its lines for $12, the offer including a standard 6-lb. electric iron and one 60-watt tungsten lamp. It was specified, moreover, that the wiring should be done in such manner that if the owner of the property should decide later to wire the entire house this portion would not have to be done over. This offer was made mainly for the purpose of developing inquiries, the company relying upon the salesmanship abilities of its new-business department.

Another "bargain" offer was that in which the company proposed to wire any five-room one-story house on its lines, with full equipment of tungsten lamps and an electric iron, for $18.59. The monthly-payment plan was offered in both cases.

Both of the foregoing offers were persistently advertised in the local newspapers for several weeks, and brought many inquiries into the office.

The result of the twelve-dollar offer was the actual equipment of four kitchens or laundries, while about twenty inquirers decided, after looking into the proposal, to have their entire houses wired.

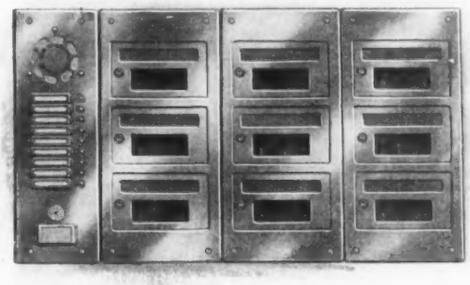
Under the offer at $18.59 a number of small homes were wired, and inquiries are still coming in, although this offer has not been advertised for several months.

The rates of the Sandusky company, which is one of the properties operated by W. S. Barstow & Company, are comparatively low, and one of the company's advertising slogans is: "None but the rich can afford to be without electric service. They have money to burn."

NEW APPARATUS AND APPLIANCES

Cordless Vestibule Telephone

The Connecticut Telephone & Electric Company, Meriden, Conn., has just placed upon the market a vestibule telephone outfit of the cordless type which is equipped with concealed transmitters and receivers. In the accompanying illustration is shown that part of the

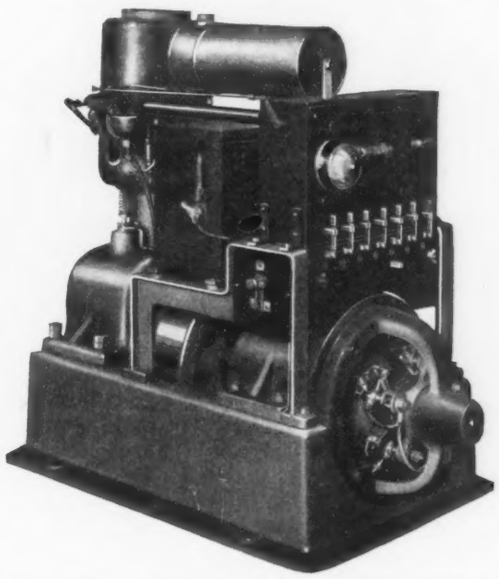


TELEPHONE OUTFIT FOR VESTIBULE OF APARTMENT HOUSES

equipment which is installed in the vestibule. There is nothing on the face plate except the card holders and buttons. To operate one of the telephones it is only necessary to push the button opposite the name of the party in the apartment desired, and talk. A loud-talking receiver is provided, so that the person calling from the vestibule can hear the other party at quite a distance from the telephone. The perforated sound openings on the front of the plate are protected by a bug-proof brass screen. The manufacturer directs attention to the fact that with this outfit there are no cords or receivers which might be stolen or tampered with.

Small Self-Contained Generating Plant

A compact gasoline-engine-driven generating outfit, which is 22 in. wide, 32 in. long and 35 in. high, is shown herewith. The engine is of the four-stroke-cycle, one-cylinder type and in design is similar to that of an automobile engine. The bore is 3 in. and the stroke 4.5 in. The engine is connected to the generator by a side disk crank carried on the engine end of the armature shaft. A twelve-cell lead-plate storage battery and an inclosed self-controlling device mounted above the generator complete the plant. The outfit is mounted on a rigid cast-iron base as shown in the illustration. The entire plant weighs 750 lb. The outfit is rated at 750 watts and is operated at 32 volts, the pressure being maintained constant by regulating the speed of the engine. The maximum speed of the outfit is 845 r.p.m. to 850 r.p.m., which is only reached at full load. Assuming that the plant is at rest when a lamp or other device is placed in the circuit, the generator is connected to the storage-battery circuit and acts as a motor, cranking the engine. As soon as the engine comes up to speed the machine is operated as a generator. The outfit is being made by the L. B. Jones Company, 3310 East Fifteenth Street, Kansas City, Mo.



SELF-CONTAINED GASOLINE-ENGINE-DRIVEN GENERATING SET

Apparatus for Protecting Against Surges

For protecting circuits against high frequencies, high voltages and steep-wave fronts equipment in the form of the Moscicki condenser (Figs. 1 and 2) and the Giles valve (Fig. 3), as they are called, has recently been developed by the General Electric Company, Ltd., of Great Britain, 67 Queen Victoria Street, London, England.

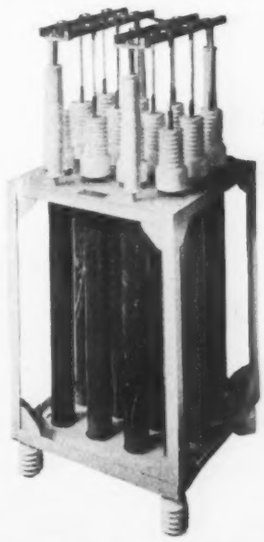


FIG. 1—BATTERY OF LARGE CONDENSERS

For protection against excess pressures of high frequency and against steep-wave fronts, the condenser is employed. In Fig. 1 is shown a battery of large condensers, and in Fig. 2 is illustrated an outdoor-type unit. The Moscicki condenser is designed to withstand peak pressures of 60,000 volts. It consists of a tube of a special glass composition, the inner and outer surfaces being coated with chemically deposited silver and then plated with copper. At the neck the tube is thickened considerably so that it will withstand the static stress, which at this point is greater than at any other part of the surface. This construction enables the thickness of the dielectric to be reduced to a minimum, thereby giving a high capacity, while there is ample security, it is asserted, against perforation of the

dielectric. The neck of the condenser is inclosed by a high-pressure insulator, the space between the neck and insulator being filled with an insulating compound in such a way that the edge of the coating is completely buried in the mass and no surface discharge can occur. Each condenser is mounted in an iron tube, the space between the condenser and tube being filled with a mixture of water and glycerine so that any local heating which might result in the perforation of the dielectric is rendered impossible, as the liquid distributes the heat throughout the whole volume. The liquid is also non-freezing at all atmospheric temperatures usually met. Owing to the compact tubular form of the condenser, units can be conveniently grouped, as shown in Fig. 1, and the length of the connections is reduced to a mini-

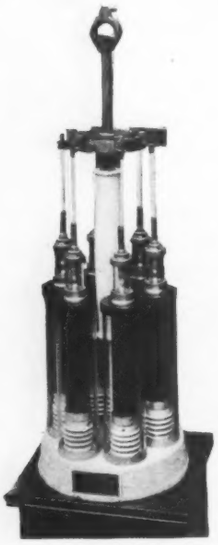


FIG. 2—OUTDOOR-TYPE CONDENSER

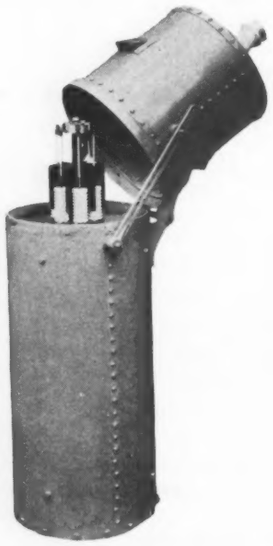


FIG. 3—VALVE FOR USE WITH CONDENSER

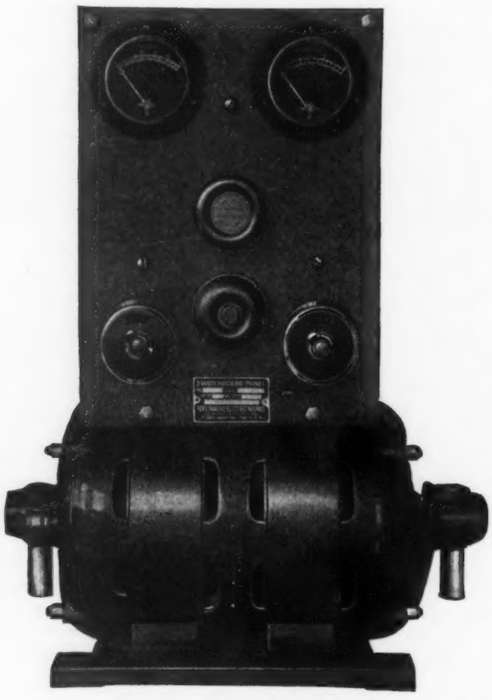
mum so that practically no self-induction is introduced.

The Giles valve is in effect a multi-gap arrester with the individual gaps shunted by condensers in place of resistors. It is designed for use as a complementary device with the condenser described above, to protect against surges of low frequency but high voltage. The device comprises a number of units in parallel, the essential features of each unit being a main spark-gap, a resistor in series and a number of small spark-gaps, each shunted by a condenser. The units are mounted together on one frame, as shown in Fig. 3. The main spark-gap is adjustable in setting and is inclosed in a small glass tube to prevent dust being deposited. The inclosure is said to improve the sensitiveness with which the gap can be set. The resistor, in the form of a wire, is mounted upon a vertical insulating tube. At the bottom of the tube are the small gaps, consisting of heavy metal rings of high heat capacity. The bottom part of the tube is filled by a metal plug and the condenser for each unit is formed over the dielectric of the tube between the plug and the metal of the ring. The interior of the insulating tube is completely filled by an insulating compound to prevent the entrance of moisture. When the pressure of the circuit rises to the point for which the valve has been set, one of the valves commences to discharge first. If the rate of discharge is adequate, the arc potential immediately drops. If inadequate, the line potential continues to rise and the next unit is set into operation, and so the process continues until the whole of the valves are at work and the surge pressure has been reduced to a safe value.

An important feature of the Giles valve, the manufacturer points out, is that on breaking the arc there is no shock to the system and no danger of the synchronous machinery falling out of step. The device starts with a high resistance, which is gradually lowered as necessity demands by the remaining units coming into operation. The reverse process is followed as the surge is discharged so that the resistance is gradually raised again. The sparks caused by the surge pressure are extinguished at every half period and, in consequence, the line current does not pass for any appreciable time, though it is, of course, limited by the high resistance. For this reason the resistors never burn out, it is asserted, although they are small, providing the surge be not due to permanent resistance or an arcing fault. Protective fuses are inserted to prevent a heavy rush of energy in case the dielectric of the valve should be perforated.

Charging Outfit for Automobile Ignition and Lighting Batteries

Apparatus designed especially for service in garages for the charging of ignition and lighting batteries has just been placed on the market by the Fort Wayne Electric Works of the General Electric Company, Fort Wayne, Ind. The outfit consists of a small motor-generator set on which is mounted a switchboard panel with switches, instruments, etc., for the control of the set.



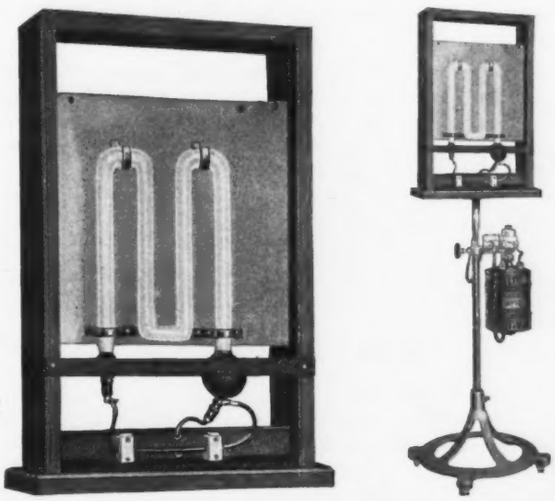
SMALL CHARGING SET FOR AUTOMOBILE IGNITION AND LIGHTING BATTERIES

The apparatus is designed for use on 110-volt or 220-volt, sixty-cycle alternating-current circuits, or on 110-volt or 220-volt direct-current circuits. Motor-generators are being made for the outfit to provide direct current at 12 volts, 18 volts or 24 volts. The switchboard is equipped with a snap switch for starting and stopping the set, a snap switch in the circuit from the generator to the batteries to be charged for opening the charging circuit, a voltmeter for reading the voltage of the generator, an ammeter for reading the charging current, and a field rheostat for raising or lowering

the voltage of the generator and, therefore, for adjusting the battery-charging current. A small push-button switch in the center of the board between the two snap switches is employed for placing the voltmeter in circuit only when it is desired to read the voltage of the set. The outfit is being made with two ratings, namely, 175 watts and 250 watts. The manufacturer points out that the set is very small and compact and may be placed upon a workbench if desired. The outfit is being made complete with all necessary equipment and it can be quickly placed in operation by connecting to the lighting circuit and to the batteries.

M-Shaped Tubular Lamp for Photographic Enlarging

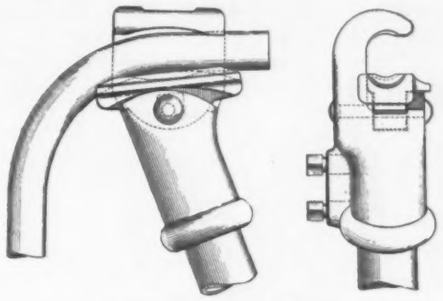
An M-shaped Cooper Hewitt lamp, 50 in. long, has recently been developed for photographic and enlarging work. The tube is provided with six 90-deg. bends as shown in the accompanying illustration and is mounted behind a pane of ground glass. The lamp is of the automatic lighting type and is turned "on" and "off" by an ordinary snap switch. No mechanical tilting is necessary for lighting the lamp. The manufacturer, the Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J., points out that the lamp provides a steady light without flicker or variations and adds that it is not necessary to use condensing lenses or other mediums to obtain diffusion. The M-shaped tubular lamp is being made for operation on direct current and on alternating current.



M-SHAPED TUBULAR LAMP DESIGNED FOR ENLARGING PHOTOGRAPHS

Tool for Bending Steel Conduit

A tool designed to bend steel conduit quickly, without flattening or kinking, is shown herewith. This "hickey," as it is called, is provided with two jaws, one of which is movable. The jaws are set at an angle to the handle and are similar at each end, thus permitting the pipe to be bent from either side. In the one case the handle can be worked through an angle of 55 deg. and in the other through 100 deg. When pressure is applied against the handle the movable jaw is automatically clamped in position. The jaws are so curved that the tool may be put on or removed from a conduit already bent, without turning it sidewise or slipping it along to the end or onto a straight portion of the conduit. The pipe handle is slipped into a socket, which is slightly tapered at the inner end. It is driven in tight and kept in place by two set screws. This tool is made of malleable iron and is being placed on the market by the Fey Specialty Company, 71 Brainard Street, Detroit, Mich.



CONDUIT BENDING TOOL

Lamp-Testing Instruments

A lamp tester or watt indicator for quickly determining the amount of energy taken by either one or two lamps has been placed on the market by the Eldredge Electric Manufacturing Company, Springfield, Mass. It is designed especially for use by salesmen in demonstrating the economy of the more modern lamps. The testing box is equipped with two spring sockets in which the lamps are inserted. By pressing either of the two switch buttons on the front of the instrument, either lamp is connected to the supply circuit, and the amount of energy taken in watts is noted on the meter. Readings can be taken from zero to 130 watts at 115 volts. The device is designed for use on both alternating current and direct current. It is inclosed in a "leatherette" case, 5.5 in. by 4 in. by 2 in. in size, and is equipped with 4 ft. of cord and a swiveled attachment plug.

LAMP-TESTING APPARATUS DESIGNED FOR QUICK OPERATION BY SALESMEN

Electric Washer with Vacuum Agitator

An electrically operated washing machine has been developed by the Wayne Manufacturing Company, 150 Sidney Street, St. Louis, Mo., having as its feature a large metal dolly or agitator which moves up and down and forces air and suds through the clothes. The inside of the washer tub, as well as the washer-tub lid, is corrugated like a washboard. The dasher is equipped with

WASHER WITH PLATFORM FOR TWO EXTRA TUBS AND BASKET

a thumb nut so that it can be quickly removed when it is desired to fill or empty the washtub. A splasher plate is provided to prevent the dasher from splashing water out of the tub. The dasher is perforated so as to release the oil and water. The clothes wringer may be operated at the same time as the washer or not, as desired. The washer illustrated herewith is equipped with an extended platform which will hold two extra tubs and a basket. The wringer can easily be adjusted to work with any of the tubs or the baskets. For instance, clothes can be passed through the wringer from the washer to the tub containing the rinsing water. Then, swinging the wringer around to the second position and locking it, the clothes can be passed from the rinsing water through the wringer to the tub containing the bluing water. Next the wringer can be swung around to the third position, and the clothes can be removed from the bluing water through the wringer into the basket. The washer tub is placed on a slant for draining purposes.

Dust Bellows for Motors

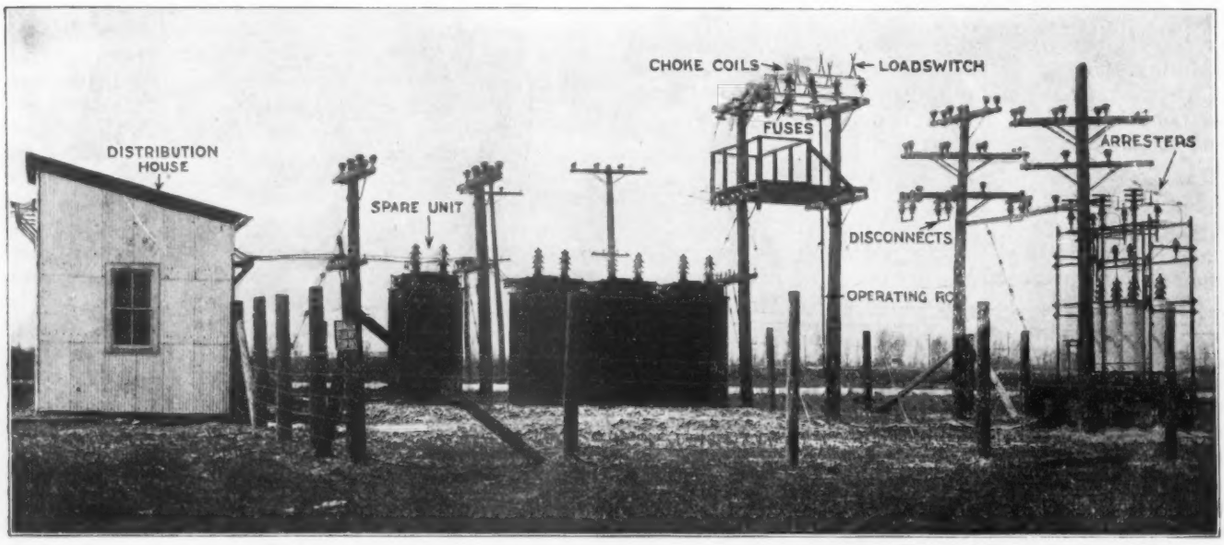
A dust expeller for cleaning motors and other electric appliances has recently been developed by the General Electric Company, Ltd., of Great Britain, 67 Queen Victoria Street, London, E. C., England. It is con-

DUST EXPELLER FOR CLEANING MOTORS

structed largely of wood, as shown in the accompanying illustration, and can be operated, the manufacturer declares, without fear of shock. The bellows is also adapted for cleaning typewriters and other kinds of apparatus.

Outdoor Substation of Large Rating for Industrial Service

The outdoor substation equipment shown herewith is designed to change energy taken from a 33,000-volt, three-phase, sixty-cycle line to 2300-volt energy for industrial service. There are four 500-kva. transformers, one of which is a spare unit which can be quickly connected in case of failure. The high-tension control equipment consists of a three-pole air-break switch, three choke coils, and three 15-amp. chemical fuses. The lightning-arrester equipment includes three single-pole underhung disconnecting devices by means of which the arresters can be cut out of service. The secondary circuits are controlled by oil switches mounted in the distribution house from which the industrial lines are carried. The high-tension air-break switch can be controlled by means of a permanently grounded operating handle, the fuses being easily reached from the platform after the main switch is opened. The air-break switch, choke coils, fuses and disconnecting devices were manufactured by the Delta-Star Electric Company, Chicago, Ill. The electrolytic arresters are of General Electric and the transformers of Westinghouse make.



OUTDOOR SUBSTATION RATED AT 1500 KVA. FOR INDUSTRIAL SERVICE

CURRENT NEWS SECTION

Rate Reduction in Cambridge, Ohio

The Ohio Service Company, Cambridge, Ohio, has voluntarily reduced its residential lighting rate 10 per cent and has reduced the minimum charge from $1 to 50 cents per month in the Cambridge district. The company has also introduced new rates for commercial lighting and motor service. The lowest charge for commercial lighting is 3 cents per kw.-hr., and for energy for motor service 9 mills per kw.-hr. These rates are now the same in all communities served by the company in the State of Ohio.

The Work of a Hungry Rat

The picture below shows a piece of lead-covered, cambric-insulated No. 8 arc-lamp cable which was attacked by a rat in one of the manholes of the Merchants' Heat & Light Company at Indianapolis, Ind. According to Mr. A. J. Goedjen, electrical engineer of the company, this cable was installed about Jan. 1, 1915, in connection with the local street-lighting service and carries

LEAD-COVERED ARC-LAMP CABLE GNAWED BY RAT

10 amp. at 3800 volts, sixty-cycle, during the time when the lamps are operated. The cable was gnawed in this peculiar manner at a point where it enters the conduit at the side of the manhole. In this case the injury did not cause a breakdown, for it appears that the rat must have gnawed at the sheath during the day while the cable was dead. The tooth marks of the rat are easily visible on the lead sheath.

ELECTRICAL OPPORTUNITIES IN BRAZIL

Conditions and Outlook in City of Bahia for Sales of American Goods

BY H. N. DOUTHITT*

Competition may be the life of trade in the majority of places, but in the city of Bahia, Brazil, it has come very close to being the death of the electrical central-station business.

Because of the excellent initial impetus which it received, Bahia ought to be among the leading cities of South America from an electrical standpoint, but it is one of the least important. A fight to the death between two competing electric companies is mainly responsible, but this condition is less serious now and the prospect is for much better business within a short time.

The city of Bahia has a population of about 300,000. The State of Bahia, of which the city is the capital, covers 165,000 square miles of fertile land, intersected by many rivers and providing splendid opportunities for the raising of tobacco, coffee, sugarcane, cotton and cereals. In the past the cotton mills of Bahia have used all the local cotton and often have been obliged to import raw material from other States of Brazil, but owing to the recent slump in the market for manufactured cotton there was a surplus last year. The State has over 150 sugar mills. Some of these are equipped with machinery of the latest design, but most are run very crudely. This field provides fertile ground for the electrical salesman.

While the city of Bahia has not been neglected from an electrical standpoint, for the past ten years it has been the center of a bitter contest. On April 29, 1901, the Bahia Light & Power Company entered into a contract with the government of Bahia and the city of Bahia, receiving exclusive privileges for fifty years covering the distribution of gas and electrical energy except for tramway purposes. The company executed the clause concerning the supply of gas without difficulty until 1905, when the Compagnia Linha Circular (Guinle & Cia.) completed the electrification of street-railway lines in the upper city of Bahia and commenced to supply energy to private consumers. The Light & Power company secured an order from the federal court prohibiting this violation of its franchise. Guinle & Cia. secured the permission of the local court to continue the supply of energy to private consumers by citing a clause in the constitution of Brazil which was interpreted to prohibit the granting of exclusive privileges or monopolies. A continuous contest followed in the courts until 1912, when a final decision was handed down recognizing the rights of the Light & Power company. Believing that the only way out of the difficulty was to buy the Light & Power company properties, the city, with the backing of the State government, after negotiations, acquired the entire concession and property. The expense of litigation and other incidentals in the long contest were so great that the money received by the Light & Power company yielded only about 60 per cent to the original bondholders, and the stockholders received nothing. The property is therefore still the possession of the city, but the gross income is not sufficient to pay expenses. The city is therefore obliged to meet the interest, but as yet it has failed to do this.

The generating plant is old and very expensive to operate, and the city is in great need of a new oil-engine plant. To obtain this would require some time, as Bahia is not in a position to pay cash and a careful manufacturer would hesitate to extend credit under the present financial conditions. Some company must furnish the new plant as well as supply a few new cars and a large amount of repair parts. This would require a man on the ground who is capable of arranging a contract whereby the money would be taken out of the daily receipts and placed in a local bank. The Mayor, Dr. Brandao, has offered to place the difference between the cost of energy at present (6 cents per kilowatt-hour) and the cost with a new plant, estimated at 2 cents per kilowatt-hour, in the bank each day in payment. This arrangement would be rated first-class security by some of the leading European firms if they were in a position to guarantee delivery.

Is this not a good opportunity for some wide-awake American concern not only to make immediate profit but also to establish valuable connections in an immensely

*Former special agent of the Department of Commerce.

rich and rapidly growing State not too remote for a good investment?

The fight between the Guinle company and the Light & Power company cost both parties as much for litigation as they had invested in their installations. This was a great drawback to the increase in the use of electrical energy, and little electrical progress has taken place in the last few years, owing to the high rates. Had it not been for this disagreement, Bahia to-day would have 20,000 hp. in motors installed, instead of merely 1425 hp. To-day only 80,000 incandescent lamps are installed, while there ought to be at least 150,000. Energy for motor-service purposes should be selling for 3 to 4 cents per killowatt-hour instead of 6 to 12 cents, as at present.

There is a splendid opportunity in Bahia for firms which will enter the market with a full line of electrical machinery and supplies and will extend credit to reputable firms, taking security on which banks in the United States would loan money. This is the course pursued by the German houses that have made a success of export trade.

Advantages of Consolidation

In order to reduce the cost of field expense to a minimum, American manufacturers should be allowed to consolidate for export business. A sample of the working of this system is the Standard Oil Company of Brazil, with its head office in Sao Paulo and branches in all important towns. If it were not for the combined interest it would not be able to sell as cheaply as it does. It obtains the largest part of the trade.

The expense of entering the South American market in the best way is more than most of the small manufacturers can afford, and a movement should be organized to weld them into associations with the sole purpose of entering this market to win and to stay. If this conflicts with the anti-trust laws, these statutes should be waived as long as the houses deal in export trade exclusively. Is not the foreign trade and the merchant marine of the United States more important than the very small benefit which might accrue through a strict interpretation of the Sherman law?

An English bank manager told me that one reason why we have not been able to secure more of this trade is because we have had to deal with houses with which we were not acquainted and we were not willing to accept their statement as to conditions. He did not say, however, as he might have done, that we should have more confidence in the people we were dealing with and that we should have personal representatives at the other end who, if a shipment arrives in bad order, could adjust the matter with the purchaser immediately. Such a representative should be of high standing in the United States, so that when he makes a statement to his firm as to the standing or credit of a customer a bank would grant credit on the strength of his recommendation.

If an American who has been to Bahia states that Americans are not liked in that district, either he is a habitual pessimist or he has been to Bahia and failed to succeed. Americans are not known very well in Bahia, but they are well liked and most of the American material is their criterion of quality. I have never found an American of good standing who did not have the respect of the natives to a greater degree than representatives of the other nationalities.

One of the mistakes made by the average commercial representative is that of covering the field too rapidly. To make a report on a State the size of Pernambuco or Bahia would require at least two months, as no man can cover either of these States merely by visiting their capitals, though many representatives of American firms make the mistake of thinking that they can do this. The market for the American firm that believes in its output, maintains its output at a high standard of quality and pays attention to the particular demands of the people is almost unlimited.

I called upon a firm in Bahia which handles a small line of electrical fixtures, mostly German, and urged the superiority of our goods. The manager agreed as to the quality and admitted that the fixtures were better for the money than those he was handling.

"Why, then," I inquired, "don't you give up the German product and sell the American fixtures?"

"Because," he answered, "the German fixtures are cheaper and the designs are more flashy. Likewise they are made of lighter materials, which is a big item, as fixtures pay duty according to weight."

Few customers of this firm will know the difference in the products, as most of the fixtures are sold on appearance instead of on quality. The director of a cotton mill told me that our cotton cloth was the best on the market and admitted that our machines must be the best in order to turn out such a high grade of work. Even so, he added, he preferred to buy from the representative of an English company rather than from an American unless he could purchase from a firm established in Bahia and sure to stay there. The English and the Germans have noted the tendency on the part of the South Americans to like local representation, and that is one reason for their commercial supremacy despite the almost universally admitted superiority of American manufactured goods.

The sale of electrical machinery and supplies is very much neglected in Bahia, owing to the retirement of Guinle & Cia. from the market. This firm was organized some years ago and has been of great service to United States manufacturers in placing electrical goods in the Brazilian market. It was the agent for the General Electric Company, prior to the opening of the company's office in Brazil under the name of the General Electric Company of Brazil.

Guinle & Cia. had their head office in Rio de Janiero, with branches in Sao Paulo, Bahia, Petropolis, Nichteroy, Bello Horizonte and several smaller cities.

At present five firms in Bahia are carrying a small line of supplies, 85 per cent of which are made in America. Bromberg, Hacker & Cia., a German firm, opened a branch in this city recently, but have a very small line because of the difficulties in receiving goods. Siemens & Cia. have a small store in Bahia, but are doing little because of the difficulty in making deliveries.

American Products Better than German Ones

Drummond & Moraes, a local hardware house, handle a small line of fans, fixtures, lamps, electric specialties and wiring materials. The lamps and fixtures are of German origin, but the other articles are from the United States. The proprietors admit that the goods from Germany are not of so high quality as the American products, but say that they are better adapted to the local trade and, being of lighter materials, are more economical with respect to duties. The duty on goods of this nature averages 55 cents per pound, so that it will be appreciated that in the long run the lighter goods are much cheaper.

Antonio Braga also has a small electrical house, carrying about the same line of goods as Drummond & Moraes, and he also buys lamps and fixtures from Germany because of their weight and flashiness.

The close of the European war will see a great improvement in the market for electrical materials. If the United States desires to share in this great volume of business, however, it must take immediate steps to secure the confidence of the people and the firm foundation which is essential to success in Brazil.

To Enlarge New Orleans Radio Station

The bureau of steam engineering of the Navy Department, which has charge of radiotelegraphic apparatus, installations and inventions, is enlarging the New Orleans naval radio station. The original plant contained a 5-kw. set, but this has been taken out and a 30-kw. set is being installed. The station will be used principally as a relay station for messages between Atlantic and Pacific Coast stations, and between Darien, on the Panama Canal Zone, and Arlington, outside of Washington, although Darien and Washington are now working together. The work at New Orleans is nearing completion.

Pacific Gas & Electric Report

In connection with the ninth annual report of the Pacific Gas & Electric Company, covering the fiscal year ended Dec. 31, 1914, the company published a supplement giving the results of operations during the first five months of 1915 and a balance sheet as of May 31, 1915. The arrangement of the report is an innovation and will be used in the future as the company's standard form.

In the new form the income and surplus account statements appear first with an analysis of each of the important items in their order. This is followed by a certified balance sheet with a similar analysis. The physical and operating statistics of each department appear next, with explanatory text and matters of general interest. The report closes with charts.

During the seventeen months covered by the report, Jan. 1, 1914, to May 31, 1915, the following progress was made:

Gross operating revenues increased	$1,722,990
Total net income increased	$1,934,449
Consumers gained—net	39,725
Extensions and additions made at a net cash cost of	$3,592,326
Bonds and cash in sinking funds increased by	$1,432,015
Current assets increased by	$1,973,111
Current liabilities decreased by	$3,054,510
Total betterment in current financial condition	$5,027,621
Current cash increased	$1,035,605
Secured obligations decreased by	$3,215,500
Number of stockholders increased	3,916
All one-year notes and floating debt paid, thus eliminating annual interest and discount charges of	$622,860

Of the total operating revenues of $16,912,688, the sum of $8,759,449 was derived from the sale of electrical energy and $7,015,408 from the sale of gas, the remainder being derived from electric-railway operations and the sale of steam and water. Electric sales increased by 6.42 per cent and gas sales by 7.14 per cent during 1914. The profit on merchandise sales and other miscellaneous income was $307,816 for the year, or a decrease of 7.65 per cent. The operating revenues of the electric department follow:

	1914	1913
Commercial and residential business	$3,973,012	$3,642,837
State, county and municipal business	739,083	662,566
Sales of electricity—agricultural industry	350,551	419,093
Sales of electricity—mining industry	591,314	557,462
Sales of electricity—transportation industry	756,343	696,324
Sales of electricity—manufacturing industry	1,553,640	1,476,105
Sales of electricity—other electric light and power corporations	304,031	343,430
Sales of electricity—commercial and miscellaneous	487,714	431,337
Temporary lighting and motor service	3,761	1,628
Totals	$8,759,449	$8,230,782

Fifty-one per cent of the year's gross income, including miscellaneous income, was derived from sales of electricity, 41 per cent from gas, 3 per cent from electric-railway operations and 5 per cent from miscellaneous operations. During the last seven years the gain in income from the electric department was $2,442,820. Of the total gross operating revenues in 1914, 94 per cent was derived from private consumers and the remaining 6 per cent from the state, counties, municipalities and other governmental subdivisions for street lighting and other public purposes.

The increase during 1914 of $1,043,681 in gross operating revenues was accompanied by a net addition of 29,321 consumers, bringing the total number of customers served at the close of 1914 up to 378,705. The gain in customers during the past seven years has been at the average rate of 28,013, or more than 14 per cent per annum. On Dec. 31, 1914, the company had 148,957 electric consumers, which was a gain of 16,602 during 1914 and of 94,185 in the last seven years. The average gross revenue per electric customer in 1914 was $58.80, as against $31.84 per gas customer.

Maintenance, operating expenses, taxes, etc., decreased $417,285, bringing the ratio of these expenses to gross earnings from 58.8 per cent in 1913 down to 52.7 per cent in 1914. This net reduction was effected notwithstanding an increased output of more than 37,000,000 kw.-hr. and of more than 218,000,000 cu. ft. of gas.

While the expenses for the preceding year included certain extraordinary items due to labor troubles, which were not duplicated in 1914 to any extent, nevertheless substantial economies were effected during 1914. In last year's report it was predicted that the inauguration of service from the new Drum power house and the assurance of a normal water supply for hydroelectric plants, as contrasted with the state-wide and abnormal shortage of water during the preceding season, would lead to a substantial reduction in the cost of operating steam stations and to the discontinuance in a large measure of power purchases from outside sources. This prediction has been verified by the reduction of $189,854, or almost one-third of the amount of fuel oil consumed at steam stations, and by a reduction of $191,186 in the amount of electrical energy obtained from extraneous sources. The operating expenses of the electric department decreased $566,151, and those of the gas department decreased $39,635. The net income increased $1,435,451. The net earnings of the company after bond interest have aggregated $25,896,652 in the nine years since organization. Of this amount but 22 per cent ($5,237,086) was paid out in cash dividends, and the remaining 78 per cent ($20,659,566) was reinvested in the property, applied to the reduction of funded debt and for other corporate purposes.

The expenditure for net plant additions during the year amounted to $2,733,949, and during the past nine years such expenditures have amounted to $41,248,730. At the close of business Dec. 31, 1914, the company had outstanding a total of $79,268,300 in bonds and notes, which was a decrease of $1,217,500 over the amount outstanding the year previous. Capital stock outstanding in the hands of the public on Dec. 31, 1914, in comparison with the stock outstanding at the end of the previous year, was as follows, the increase of $8,801,300 having been occasioned entirely by the sales of new first preferred stock:

	Dec. 31, 1914	Dec. 31, 1913
First preferred 6 per cent cumulative	$8,801,300*	.....
Original preferred 6 per cent cumulative	10,000,000	$10,000,000
Common stock	32,109,300	32,109,300
Total	$50,910,600	$42,109,300

*Includes stock subscribed for but not fully paid and issued.

The new construction in the electric department, in common with the other departments, was limited mainly to the extension of distribution facilities as demanded

by the addition of new customers. No additional generating plants were constructed, the completion of the Drum power house on Nov. 25, 1913, with an installed capacity of 33,333 hp., having provided for the growth of business, besides permitting a large reduction to be made in the amount of energy purchased from other companies and in the amount generated at steam stations. This new plant in the first full year of its operation has given excellent results. During the month of October it carried a peak load of 25,900 kw., or 900 kw. more than its total rating. Its output during the year has amounted to 76,964,400 kw.-hr. The load-factor on the entire system during the year was 60.6 per cent, and the peak load carried by all the stations aggregated 166,273 hp.

The connected load in motors, appliances and lamps on the system increased during the year to 478,598 hp., this load being 52,815 hp., or 12 per cent, greater than in the preceding year.

Energy generated at steam stations decreased more than 62,000,000 kw.-hr., thereby causing a decrease of 360,249 barrels of fuel oil used in these stations.

Gross operating revenues during the first five months of 1915 increased $679,309. Of this increase $128,000 was due to revenues derived from service to the Panama-Pacific International Exposition. The net gain in customers during the first five months of the year was 10,404, as compared with a net gain of 7185 in the first five months of 1914. From Dec. 31, 1913, to May 31, 1915, the capital assets increased by $3,592,326, which represents the net cash cost of extensions, betterments and improvements during the seventeen months. No large capital expenditures are in contemplation during the remainder of the year.

There has been no change since Jan. 1, 1914, in the aggregate amount of issued and outstanding capital stock of the company except the increase brought about through the sale, since June 3, 1914, of $10,177,300 of first preferred 6 per cent stock to stockholders, employees and customers of the company. Up to May 31, 1915, $6,039,600 had been subscribed by stockholders and $4,137,700 had been purchased by employees, patrons of the company and others.

In connection with the offering of the new first preferred stock Mr. Frank G. Drum, the president of the company, says: "When this plan was first presented to stockholders, conditions throughout the United States did not encourage the investment of funds in long-term securities. We anticipated, nevertheless, that substantially the entire issue of $12,500,000 would be taken by stockholders. Less than two months later, however, the outbreak of the European war completely demoralized the investment situation and not only reduced domestic subscriptions but brought about a practical cessation of subscriptions from our foreign stockholders, many of whom up to that time had not only taken the amount of stock allotted to them but had subscribed for additional amounts. That, in the face of these unprecedented conditions, it was possible to declare the new plan operative on Aug. 15, 1914, and subsequently to increase the subscriptions to the above stated amount, may, we believe, be attributed to the unquestionable excellence of the security, to the attractive return upon the investment, and to the fact that throughout this most trying year the company was able to increase largely both its gross and net revenues in every month of the year."

In connection with the payment of dividends Mr. Drum says: "The board has also given the most careful consideration to the question of the payment of cash dividends on the common stock, and its decision that no disbursement, in addition to that already announced, ought to be made during the remainder of the year has been taken solely from the viewpoint of protecting the company against any contingencies that may arise out of the present foreign and international situation.

"The company's present condition, which we believe has been fully and fairly set forth in this report, is most excellent. Its properties have been well maintained and are at the maximum of efficiency. Its large construction work has for the time being reached a definite stage of completion, and no extraordinary capital expenditures are imminent. Gross and net earnings, irrespective of the temporary revenue derived from the Exposition, are continuing to increase at a satisfactory rate, and a substantial percentage upon the common stock is being earned. The company is entirely free from floating debt, is on a cash basis, and has an ample working capital. These conditions would ordinarily render a dividend policy easy of determination. The European war has, however, created an unprecedented state of affairs. The Continental markets are no longer a source of new capital. The domestic market for long-term investments, notwithstanding the great improvement and the many hopeful features in the situation, is also of a most casual character. These are known factors which have an immediate bearing on our affairs, as our business is growing and the cost of new construction incident to this growth must be defrayed either from current resources or from the sale of securities. The duration and ultimate financial consequences of the war are the unknown factors which in a still larger degree impose upon the board the obligation of conserving the company's cash resources until more dependable conditions again prevail in the securities markets."

Philadelphia Electric Company Files Inventory in Rate Case

The Philadelphia Electric Company has filed with the Pennsylvania Public Service Commission an inventory of its property, completed at a cost of $150,000 to $200,000, and set forth through its attorneys that the valuation could not be made until Nov. 15. The complainants asked that an expert be named to check the inventory and appraisal, that copies of the summary be furnished and access given to the inventory, and that an early date be fixed for the hearing on the street-lighting rates.

The commission did not take any action, but suggested that the complainants have an examination made of the inventory and report to the commission by Sept. 7 what they thought of it. Meanwhile the commission engineering staff will examine the work. At a conference between the commission, the complainants and the defendants the controversy was gone over and counsel for the complainant, Mr. Harold Evans, charged delay. Mr. F. W. Fleitz, counsel for the defendant, contended that the company is advancing the work as rapidly as possible and desires a logical and legal conclusion. Mr. Evans contended that it would not require the time stated to make the appraisal, but Chief Engineer Snow of the commission asserted that, in his opinion, it would take three months to check the work. The commission went into executive session after the conference to consider the situation.

The inventory details comprise 72,560 pages of data bound into 368 volumes, and it is said that as many as fifty-six clerks were used by the company in getting out the report. Eleven divisions were made in listing the property, the detailed data of the items coming under each division filling one summary volume of ninety-seven pages.

Miscellaneous News Notes

Louisville Board of Trade Favors Fixing of Resale Prices.—At the request of the Chamber of Commerce of the United States the Louisville Board of Trade, through its chairman, Mr. James Clark, Jr., has placed itself on record as favoring the system by which manufacturers may fix the resale price of their products.

An Electric Slogan Sign for Georgetown, Ky.—If some one will supply a civic-slogan sign to be erected near the Queen & Crescent Railroad at Georgetown, Ky., Mr. Samuel L. Allen, superintendent of the local lighting company and also president of the Georgetown Commercial Club, offers to supply the energy to light it and to maintain it. On the legend of the sign it is proposed to call the attention of the traveling public to the business advantages offered by the city.

Reduction in Rates in Sioux City, Iowa.—The Sioux City (Iowa) Gas & Electric Company has announced reductions in its rates effective on Aug. 1, 1915. The company is installing additional equipment and expects with these improvements to reduce the cost of energy in order to offset part of the reduction in price. A large increase in sales is also expected. The maximum rate under the new schedule, which became effective on Aug. 1, 1915, is 9 cents net per kilowatt-hour.

Examinations for Electricians in Massachusetts.—Examinations for master electricians and journeymen who intend to engage in the installation of electric wires for light, heat and power in the State of Massachusetts under the new licensing law were held simultaneously at 11 a. m. Aug. 12 at Boston, Fall River, Lowell, Pittsfield, Springfield and Worcester. Two classes of licenses were issued—one covering master electricians and contractors and the other journeymen electricians.

Rotterdam's Lamp Trade with the United States.—The exports of electric lamps and bulbs from Rotterdam to the United States during 1913 totaled $287,113, and during 1914 totaled $598,300. Most of the 1914 trade was in metallic-filament lamps, the value being $559,148. In 1913 the electric-lamp trade amounted to 3.5 per cent of the total exports to the United States from Rotterdam, and in 1914 to 5.5 per cent. Rotterdam's export trade in electric lamps to the Philippines was small. In 1913 it was $5,486, and in 1914 it was $1,114.

Street Lamps as Aids to Amateur Weather Prophets.—The "loom" of street lamps shining into the atmosphere through trees and buildings near his home is used by an amateur weather prognosticator of Battle Creek, Mich., to determine the character of the next day's weather. Before a storm, he points out, the atmosphere is moist and heavy, and the beams of light from the street arcs can accordingly be traced far up into the air. In fair weather, on the other hand, the air is practically transparent, and the shadows are short, if, indeed, they can be detected at all. The observer declares that his system is based upon fifteen years' observation and has been useful in predicting the approach of storms from twenty-four hours to forty-eight hours before they occurred at Battle Creek.

Ohio Tax Commission Enjoined in Wheeling Case.—The Wheeling Electric Company, Wheeling, W. Va., has secured an order from the United States District Court at Columbus, Ohio, enjoining the Ohio State Tax Commission from certifying the valuation of its property to the auditors of the counties interested in eastern Ohio. The question raised is as to the authority of the commission to fix the value of the property of the company in another state when most of its business is done in Ohio. Many oil, gas and electric companies in West Virginia sell the greater part of their product or service in Ohio. Attorney General Turner, it is said, will bring all the questions involved before the court in this case, so that the decision will cover the various problems that have been bothering officials.

New Street-Lighting System in Service at Youngstown, Ohio.—The new street-lighting system at Youngstown, Ohio, which was operated for the first time this week, includes about 3½ miles of underground construction in the downtown district, through which energy is supplied to 545 600-cp., 20-amp. series Mazda gas-filled lamps. Each lamp is operated through a separate series of transformers which insulate the lamp standard from the high potential of the main circuit. In the residence district 185 miles of overhead wiring has been erected to supply service to the 3200 100-cp., 6.6-amp. series gas-filled lamps. The system was installed by the Mahoning & Shenango Railway & Light Company of Youngstown, Mr. C. Whitford Jones of Cleveland, Ohio, acting as consulting engineer. The Banner Electric Division, National Lamp Works of the General Electric Company of Youngstown, furnished the lamps for the new installation.

Energy from Government Dam at Minneapolis and St. Paul.—H. M. Byllesby & Company, managers of the Northern States Power Company, state: "The amount of electrical energy which can be produced by the unfinished Mississippi River navigation project known as the "government high dam" is but a fraction of the total electrical requirements of Minneapolis and St. Paul. Present discussion in Minneapolis relates to proposals for utilizing the prospective high-dam energy for various municipal and State purposes, such as street lighting, pumping water and lighting and motor service at the State university. The disposition of this energy is not an important matter to the Minneapolis General Electric Company, the Consumers' Power Company, or other subsidiaries of the Northern States Power Company, all of which maintain a definite policy of practical and efficient co-operation in the best interests of the communities served."

An Imperial Tribute to the Memory of Herr Rathenau.—The character and service of Dr. Emil Rathenau, founder and director of the Allgemeine Elektricitäts-Gesellschaft and the Berlin Electricity Works, whose death at Berlin, June 20, was noted at the time in these columns, is the subject of appreciative testimonials from his associates and distinguished officials of the German government, which are published by the Berlin central-station organization in a memorial pamphlet, copies of which have just reached this country. In addition to the comments by Chancellor Bethmann-Hollweg, Privy Councillor Wermuth and Dr. H. Passavant, the following tribute was sent to Herr Rathenau's son by Emperor William, who was a close personal friend of the elder Rathenau: "I feel the deepest sympathy in the great loss sustained by the Allgemeine company and yourself through the death of your father, whose friendship I highly prized. The achievements of his busy and successful life and their effects on the electrical industry assure him a glorious page in the history of German industry and applied science. I shall ever cherish the memory of his rich and characterful personality."

Associations and Societies

Dallas Electric Club.—Mr. Dan G. Fisher, president of the Dallas (Tex.) Electric Club, entertained the club on Aug. 13 with an account of his recent trip to California. The club meetings are held weekly at the Oriental Hotel, Dallas.

Louisville Electric Clearing House.—Members of the Louisville (Ky.) Electric Clearing House at their Aug. 9 meeting heard the report of Mr. Frank E. Good of F. A. Clegg & Company, Louisville, who represented the Kentucky Electrical Contractors' Association at the recent national convention at San Francisco. Mr. Good's talk was devoted principally to discussion of those features of the new National Code which will affect the Louisville contractors when they become effective.

New Officers of Meco Section, N. E. L. A.—At the recent annual meeting of the "Meco" Section of the N. E. L. A., made up of employees of the Metropolitan Electric Company of Reading, Pa., Mr. A. L. Hart, manager of the company's motor-service sales department, was elected chairman and Mr. L. M. Walton was chosen vice-chairman. Mr. W. J. Comley was appointed secretary and Mr. G. L. Roller was made treasurer. Mr. George F. Thompson was awarded the prize for the best paper presented at a section meeting during the year.

Convention of Municipal Electricians.—The twentieth annual convention of the International Association of Municipal Electricians will be held at the Hotel Gibson, Cincinnati, Ohio, on Aug. 24 to 27. The following papers will be presented: "The Advisability of Using Concentric Wiring in This Country," Mr. R. A. Smith, city electrician, Norfolk, Va.; Fire-Alarm System for Industrial Plants," Mr. Albert J. Cross, of New York; "Vacuum Arresters," Mr. G. Francis Gray, electrical engineer, Schenectady, N. Y.; "The Scope and Present Status of the National Electrical Safety Code," Mr. W. J. Canada, electrical engineer, Bureau of Standards, Washington, D. C.; "Practical Cable Maintenance Methods," with demonstration, Mr. O. F. Tallman, St. Louis, Mo.; "Storage Batteries for Fire-Alarm Purposes;" "The Work of the Bureau of Standards," including some account of the co-operation of the bureau with municipalities in securing electrolysis mitigation and improving electrical service and meter accuracy, Dr. E. B. Rosa, chief physicist, Bureau of Standards, Washington, D. C., illustrated by stereopticon; "Uniform Electrical Standards," Dr. John Price Jackson, commissioner of labor and industry, State of Pennsylvania; "The Responsibility and Importance to the Public of the Office of Municipal Electrician or Superintendent of Fire and Police Telegraph," Mr. W. H. Flandreau, president of the association and city electrician, Mount Vernon, N. Y.; "Police-Patrol and Fire-Alarm Records," Mr. Price I. Patton, second assistant manager electrical bureau, Philadelphia, Pa.; "Lightning Protective Apparatus for Fire and Police Telegraph Circuits," Mr. L. S. Brach, Newark, N. J.; "The Fallacy of Placing Fire and Police-Alarm Wires in Telephone Cables," Mr. C. E. Convers, city electrician, San Antonio, Tex.; "Jovianism," Mr. Walter E. Bischoff, St. Louis, Mo.; discussion of standards for fire-alarm installation, Mr. F. A. Raymond, National Board of Fire Underwriters, New York.

Public Service Commission News

Ohio Commission

The Ohio Public Utilities Commission has decided that the Union Gas & Electric Company of Cincinnati shall give a bond of $50,000 to insure the payment of a rebate to consumers, should the rate be made less than that now being charged by the company as a result of the appeal against the new ordinance. The courts are to decide the responsibility of the People's Power League, which filed a petition for a referendum vote on the ordinance. This also acted as a stay in preventing the operation of the ordinance. The No Referendum League of Cincinnati has requested Attorney-General Turner to file an injunction suit to prevent a referendum vote on the franchise. The claim is made that the Public Utilities Commission has sole authority to handle the rate question and that a vote on this ordinance, under the circumstances, would be illegal.

Missouri Commission

The commission has issued General Order No. 20, containing rules regulating gas, electric and water service, effective on Oct. 1, 1915. Complete equipment for all tests specified will be maintained at the laboratories of the State University at Columbia, Mo. The engineering laboratories of the State University will be prepared to standardize all testing equipment submitted for a nominal fee.

Interest at the rate of 6 per cent per annum, payable annually or upon the return of any deposit, shall be paid by the utility provided the deposit remains for at least six months; the rate of interest shall be only 3 per cent if the utility keeps the cash deposit in a separate and distinct trust fund deposited as such in some bank or trust company and not used by the utility in the conduct of its business. Instead of the annual payment of interest on cash deposits any other interval between payments agreed to in writing by consumers will be satisfactory to the commission.

Nine of the rules are devoted especially to electric utilities. Any electric service meter will be tested at the laboratories of the School of Engineering of the State University at Columbia, Mo., on written application of the consumer or utility to the dean of the School of Engineering for such tests.

All secondary standards and the working standards of utilities not required to maintain secondary standards must be submitted at sufficiently frequent intervals to insure unquestionable accuracy to the engineering laboratories of the State University at Columbia, Mo., or the Bureau of Standards at Washington, D. C., or to some testing laboratory of recognized standing for calibration where the utility does not maintain a testing laboratory having primary standards.

New York Commissions

On an opinion by Commissioner Carr, the Second District commission has decided the case of the Board of Supervisors of Orleans County and the trustees of the village of Albion against the New York Telephone Company as to increase of rates. Commissioner Carr finds that careful study of the elaborate inventory and appraisal and the figures for the business done in the area affected justifies the increases whereby two-party business lines were raised from $24 to $30 per annum and four-party residence service from $12 to $15 per annum.

The increases were made in 1911 and the complaint was filed in July of that year. It resulted in one of the most elaborate valuation records which have come before the commission. Numerous hearings were held and more than 1000 pages of testimony taken. The value determined after inventory and appraisal was based somewhat on the testimony of the company's experts, and it was not proved that some of the amounts were actually expended. But, as a further check on the tangible value of the telephone property in service in Albion, figures were introduced to show the reproduction cost of the plant as of Dec. 31, 1912, based on actual bids received for the material required plus the expense of installing the same. The amount of this estimate cost was $276,400, which was checked by the commission's engineers and found to be substantially correct. The depreciation items were also closely scrutinized by the commission's engineers and approved.

"If it could be fairly claimed," says the opinion, "that the company was entitled to earn a return of say only 8 per cent upon the depreciated value of its property as of Dec. 31, 1912, which, it may be considered for the purposes of argument, was $208,635, then the amount of this return would be $16,690. Even dealing with the matter in this drastic manner, the company showed conclusively that it was not earning this return upon its property. It is now generally conceded that a public service corporation must set aside out of its earnings annually a certain reserve to provide for the depreciation of its property, and, if this had been done by the respondent after the increase in rates upon which the complaint herein is founded, it would still fall far short of earning a fair return upon its property notwithstanding the increase in revenue obtained by the increased rate."

Of the criticism that the company gave its local agents little authority in the Albion area the opinion says that, while it is not the intention of the commission to criticise this feature of the company's own business, the manner in which it has been referred to in the case should impel the company to a study of this practice with a view to greater economy through the elimination of unnecessary work.

Indiana Commission

The commission's decision in the Indianapolis rate cases has resulted in the filing of a substitute schedule by the Merchants' Heat & Light Company.

The lighting rates ordered for both companies were the same. Motor-service rates were practically unchanged by rulings. While the effect of the new residence-lighting rates on revenues cannot be known until they have been tried, the general attempt of the commission was to lower the residence-lighting rates of smaller consumers from 7 cents per kilowatt-hour to 6½ cents.

The Merchants' Heat & Light Company, which sought to have the commission provide the "active-room rate" system for small consumers, has filed a protest against the "socket rate" system and has asked authority for the installation of a schedule based on the other plan. Statements have been made that if the commission does not grant this request the company will take the case into the courts.

A new method of estimating the needed radiation in homes supplied with hot-water heat by the Merchants' company was ordered. The rates for heating, however, were unchanged.

The commission established the present value of the Indianapolis Light & Heat Company property at $5,800,000. This included $400,000 for going value. The cost of reproduction, less depreciation, was fixed at $4,852,777. These figures included improvements and additions to March 1, 1915. The present value of the Merchants' company was fixed at $2,000,000. A return of 7 per cent was allowed in the estimate.

The commission has approved a contract between the city of Connersville and the Hydro-Electric Light & Power Company of Connersville under which the company will furnish the city lighting for ten years.

California Commission

The city and county of San Francisco in a complaint against the Pacific Gas & Electric Company as to electric rates, filed with the commission, says that, now and for a long time past, the company's charges have been excessive. Among the statements made by the complainants are the following:

"That the company has no special franchise so to supply gas or electricity, except any rights given it under the constitution before Oct. 10, 1911; that maximum rates for electricity were fixed by the supervisors before July 1, 1914; that before July 1, 1915, the same rate schedule was reenacted for the fiscal year, or until the Railroad Commission should fix other rates; that many members of the Board of Supervisors believed that the rates they fixed were too high, but passed them solely because they knew that the Railroad Commission would have power in August to lower them, and that immediately after fixing the rates the supervisors directed the city attorney to petition the Railroad Commission to fix reasonable rates for electricity; that the rates in effect are discriminatory, in that the company meets competition in the commercial and industrial sections of the city and county by charging . . . for light and power very much lower rates than the maximum rates established by the ordinance. This discrimination is unfair to the residential districts."

The city and county beg the commission to investigate the rates and rules of the company, and, after a hearing, to fix reasonable rates for heating, lighting and motor service among the different classes of consumers.

Oregon Commission

A decision handed down by the commission involves a critical analysis. Much time and labor were spent in a complete valuation of two hydroelectric companies and a corresponding investigation into rates. The decision is in the case of citizens of Hood River against the Hood River Gas & Electric Company and the Hydro-Electric Company, and on the application of the companies for increased rates. Residential rates are found too low and slight increases in these rates are approved and ordered by the commission.

The Hood River Gas & Electric Company operated in the Hood River Valley, about 60 miles east of Portland, in a highly developed rural community. Available waterpowers along the Hood River led to competition by the entrance of the Hydro-Electric Company. For a number of months rates were cut until finally the interests back of the Gas & Electric company bought control of the Hydro-Electric Company. The offices were consolidated, and temporary schedules were agreed upon pending investigation by the commission.

The substance of the decision may be found in the accompanying table, showing the cost of energy for different classes of consumers in Hood River Valley, and the profit or loss in each class of service, the valuation fixed by the commission, and the extra losses omitted from expense items.

The commission lowered commercial lighting rates, made a slight increase in residential lighting rates, and reduced rural lighting rates by cutting the monthly minimum. The table shows the rates that the commission considered necessary to meet all expenses and an 8 per cent return. The commission stated that it would not be possible to make rates on this basis for the rural districts, because the traffic would not stand it. Practically all the rural business, with the exception of energy for rural motor service, showed a loss on the commission's analysis.

The commission declined to allow as usual operating expenses $2,500 paid in legal fees growing out of a suit during the competitive war, stating that the suit was unnecessary, and also refused to allow a damage judgment of $10,000 to stand as an expense because it contended that with proper operating methods the injury to the workman would not have resulted.

The commission ordered a net rate of 10, 8 and 5 cents per kw.-hr. for residential consumers in the city of Hood River, the rate breaking on two 15-kw.-hr. steps. A minimum monthly charge of $1 was found reasonable. Energy for commercial lighting was ordered to be sold at 10 cents for the first thirty hours' use of the demand and 5 cents for all over that, with a $1 minimum. The order provides for rural rates of 12 cents net for the first 30 kw.-hr. a month, 8 cents for the next 30 kw.-hr. and 6 cents for all over 60 kw.-hr. a month. The minimum was reduced from $1.50 to $1.25 a month. A gross cooking rate of 5 cents was ordered, but it is understood that the companies will reduce this voluntarily to 4 cents gross, with 10 per cent discount for prompt payment.

COSTS FOR DIFFERENT CLASSES OF CONSUMERS OF THE HOOD RIVER GAS & ELECTRIC COMPANY

	City Customers						Rural Customers				
	Residences	Stores	Signs	General Industrial Power	Refrigerator Power	Cooking Power	Domestic Light and Power	General Industrial Power	Refrigerator Power	Cooking Power	Lumber Mills
Operating revenue	$9,844.19	$11,696.54	$46.52	$25,730.03	$3,165.70	$474.76	$10,866.98	$2,203.00	$708.29	$39.33	$3,951.79
Operating expenses	$6,430.52	$3,213.93	$14.16	$788.41	$1,635.21	$129.60	$7,999.80	$1,163.29	$565.13	$32.13	$2,685.25
Depreciation	1,849.09	917.96	2.42	357.98	680.13	46.35	2,246.01	407.13	215.77	6.47	1,013.32
Taxes	569.00	284.30	1.30	60.84	144.64	11.48	707.77	102.56	50.00	2.86	238.21
Uncollectible revenue	214.61	255.00	1.01	56.10	69.02	10.35	225.33	45.66	14.63	.81	81.82
Net operating income less uncollectible revenue	$780.97	$7,025.35	$27.63	$1,300.70	$636.70	$276.97	—$311.93	—$484.36	—$137.29	—$2.94	—$66.81
Value of property in public service	$53,026.54	$25,208.49	$74.37	$8,977.02	$17,413.70	$1,262.28	$56,343.95	$10,078.70	$5,234.59	$159.49	$24,742.64
Working capital, other than stores and supplies	839.15	997.06	3.97	219.32	269.85	40.48	925.90	187.70	60.35	3.35	336.70
Total operating property and working capital	$53,865.60	$26,205.55	$78.34	$9,196.34	$17,683.55	$1,302.66	$57,269.85	$10,266.40	$5,294.94	$162.84	$25,079.34
Return on operating investment, per cent	1.45	27.08	35.20	14.16	3.60	21.25	—.55	4.81	—2.60	—1.80	—.27
Average revenue per kw.-hr. sold, cents	**7.11**	**8.07**	**8.63**	**5.96**	**1.19**	**5.09**	**12.53**	**3.62**	**1.66**	**5.23**	**2.01**
Average revenue per kw.-hr. sold necessary to yield operating expenses	4.64	2.22	2.63	1.82	.61	1.39	9.22	1.91	1.33	4.28	1.39
Average revenue per kw.-hr. sold necessary to yield operating expenses, depreciation and taxes	6.38	3.05	3.32	2.82	.93	2.01	12.62	2.74	1.95	5.52	1.95
Average revenue per kw.-hr. sold necessary to yield operating outgo and 8 per cent return, cents	**9.50**	**4.49**	**4.48**	**4.5**	**1.46**	**3.13**	**18.89**	**4.09**	**2.95**	**7.25**	**3.03**

Personal

Mr. Robert M. Fessenden has resigned as manager of the Public Utilities Company of Carlsbad, N. M.

Mr. J. F. Brinkmeyer has resigned as manager of the Southern Electric Company, 1100 Pine Street, St. Louis, Mo.

Mr. W. T. Lincoln has been appointed superintendent of the Westfield Gas & Electric Light Works of Westfield, Mass.

Mr. J. L. White, manager of the Oregon Power Company, Albany, Ore., has been elected vice-president of the Albany Merchants' Association.

Mr. Eugene A. Roberts has been appointed manager of the Public Utilities Company of Carlsbad, N. M., succeeding Mr. R. M. Fessenden, resigned.

Mr. C. M. Mitchell, formerly of Terre Haute, Ind., has been appointed manager of the Normal (Ill.) division of the Union Gas & Electric Company.

Mr. James T. St. Clair has been elected president and general manager of the Southern Electric Company, 1100 Pine Street, St. Louis, Mo., succeeding Mr. J. F. Brinkmeyer.

Mr. R. D. Jennison of New York City has succeeded Mr. Arthur N. Dutton as general manager of the Wheeling branch of the West Virginia Traction & Electric Company.

Mr. J. D. Bowles has resigned as electrical engineer for the Missouri Public Service Commission, effective Sept. 1, to accept a position with the Federal Light & Traction Company at Springfield, Mo.

Mr. B. E. Waltz, manager of the Corry (Pa.) City Electric Light Company, has been elected president of the company, succeeding Mr. J. W. Jackson. Mr. Waltz will continue in the capacity of manager.

Mr. P. M. Parry has been appointed division manager of the Ogden (Utah) division of the Utah Light & Traction Company, and Mr. C. W. Kendall has been made superintendent of electric sales at Ogden.

Mr. Herbert W. Thompson, purchasing agent for the Denver (Col.) Gas & Electric Light Company for the last twelve years, has been transferred to a similar position with the Toledo (Ohio) Railways & Light Company.

Mr. J. A. Whitlow, who has been chief electrical engineer for the Board of Education of St. Louis, Mo., has been appointed electrical engineer for the Missouri Public Service Commission, succeeding Mr. J. D. Bowles, who has resigned effective Sept. 1.

Mr. Gardner S. Williams has opened an office in the Corn Exchange Bank Building, Chicago, Ill., for consultation, design and supervision in construction in hydraulics, hydroelectric development, water-power and water supply. With him are associated Messrs. R. K. Holland, G. E. Ackerman, H. K. Holland, A. E. Greene and L. E. Ayres.

Mr. Herbert A. Dallas of Roxbury, Mass., has been chosen clerk of the Massachusetts board of examiners of electricians, with headquarters at Boston. Mr. Dallas was born in Boston in 1878, was educated in the local schools and at the Franklin Union, and entered the electrical field at the age of twenty. For the last nine years he has served as assistant electrical engineer of the school department of the city of Boston, in charge of electrical installation, design and maintenance.

Mr. Arthur M. Torrey, for the last four years in charge of the soliciting department of Hildreth & Company, New York City, has resigned that position to take charge of the engineering contract department of W. S. Barstow & Company, 50 Pine Street, New York City. The Barstow company is engaged in engineering and construction work in various parts of the country and also controls the General Gas and the Eastern Power & Light corporations, operating some forty public utilities in Eastern and Middle West States.

Mr. Ray Palmer, formerly commissioner of gas and electricity of Chicago, has announced his resumption of his consulting engineering practice, and is prepared to advise about or undertake general supervision of reorganizations, valuations, rates, lighting and other public utility or industrial problems requiring expert engineering and accounting service. His office is at 714 Hartford Building, Chicago. Mr. Palmer is a fellow of the American Institute of Electrical Engineers and a member of the Western Society of Engineers.

Mr. Leslie G. Ross has resigned as manager of the sales and contract department of the Superior (Wis.) Water, Light & Power Company, a position which he has held for a number of years, and has organized a company to conduct an electrical contracting, motor-repair and electric-appliance business. His company will open a store at 1305 Tower Avenue, Superior, and will assume all the unfinished wiring contracts of the Superior Water, Light & Power Company, which has decided to discontinue its wiring and supply business.

Mr. Cecil G. Rice has been appointed assistant to the president, Mr. James D. Callery, of the Duquesne Light Company, the Pittsburgh Railways Company and the Beaver Valley Traction Company, all of Pittsburgh, Pa. The position of superintendent of the claims department, heretofore held by Mr. Rice, has been abolished. When appointed superintendent of the claims department in July, 1909, Mr. Rice was credit manager of the Colonial Traction Company and a member of the Pittsburgh Stock Exchange. He was later made secretary to Mr. Callery and then general agent of the Railways company. Mr. Rice was at one time engaged in newspaper work in Pittsburgh.

Mr. E. F. Gould, who has resigned as assistant general manager and mechanical and electrical engineer of the Aurora, Elgin & Chicago Railroad, will in the future act in a supervisory capacity over the utility properties of Mandelbaum, Wolf & Lang, Cleveland, Ohio. Mr. Gould spent four years in the railway-engineering department of the General Electric Company at Schenectady, N. Y., leaving in 1903 to become electrical engineer of the Aurora-Elgin road. Later his promotion to the position of assistant general manager followed. In recent years he had also acted as consulting engineer for the Western Ohio Railroad, Lima, Ohio, one of the properties owned by the Cleveland firm with which he is now associated.

Mr. Warner H. Peberdy, formerly an electrical engineer with the Electric Bond & Share Company, New York, who took leave of that company the first of this year to prepare for service in the aviation corps of the British Empire, of which he is a subject, is now in England with the Royal Naval Aviation Service. Mr. Peberdy, who recently obtained his pilot's license and a probationary commission as flight sub-lieutenant, received his initial training at the Curtiss factory at Hammondsport, N. Y., and was afterward appointed manager of the McCurdy school of aeronautics. Mr. Peberdy received his early schooling at Rugby, England, and his engineering experience in the plant of the British Thomson-Houston Company at Rugby, the General Electric Works at Schenectady, and with Mr. C. O. Lenz, consulting engineer, New York City.

Prof. W. S. Franklin has resigned as professor of physics at Lehigh University, Bethlehem, Pa., with which he had been associated since 1897. Born at Geary City, Kan., Oct. 27, 1863, he attended Kansas University and after graduating received his degree of M.S. in 1888. Afterward he became professor of physics there, leaving in 1892, however, to become professor of physics and electrical engineering at Iowa State College. Professor Franklin first came to Lehigh in 1897, and was in 1903 appointed to the chair of physics of electrical engineering. In 1901 he received the degree of Sc.D. from Cornell. He is one of the authors of Franklin and Esty's "Elements of Electrical Engineering," a well-known textbook, and has written widely on scientific subjects in connection with mathematics, physics and electrical engineering. Dr. Franklin is now planning an extensive tour of American universities and engineering schools and expects to give a series of experimental and theoretical lectures in connection with the trip.

Mr. Pierre L. Miles, who has been appointed sales manager of the electrical department of the Globe Stove & Range Company of Kokomo, Ind., with offices at 731 Edison Building, Chicago, first entered the electrical field with the Cleveland Electric Railways Company in 1904, three years later going with the Cleveland Electric Illuminating Company as secretary to Mr. Robert Lindsay, general superintendent. Mr. Miles next entered the commercial department of the Cleveland company, taking charge of advertising and

of appliance sales. After a total service of five years with the Cleveland central-station organization, in 1911 he joined the staff of the National Lamp Works of the General Electric Company as a member of the publicity department at Cleveland. Later he traveled throughout the United States, calling on central stations and specializing in new-business studies. In 1914 he was appointed manager of appliance sales and of the house-wiring department of the Indianapolis Heat & Light Company, Indianapolis, Ind., from which position he was appointed sales manager for the Globe company.

Mr. Walter Neumuller, whose work for the past five years as assistant secretary of the Association of Edison Illuminating Companies and also as a member of the executive committee and a former member of the exhibition committee of the National Electric Light Association, has met with wide approval, has been appointed special representative of the New York Edison Company. As such he will ascertain by personal contact and observation wherein the company's commercial policy is lacking, and suggest methods of further increasing the friendly relationships existing between the utility and its patrons. For this work Mr. Neumuller's past experience and training well fit him. Born June 21, 1886, in New York City, Mr. Neumuller has been connected with the New York Edison Company for fifteen years. By conscientious work he has won steady advancement in the organization. He is also a director, treasurer and assistant secretary of the Electrical Show Company, director and treasurer of the New York Electric Vehicle Association, and director and member of the executive committee of the Electrical Refrigerating Company. Among the societies of which he is a member are the National Electric Light Association, New York Electrical Society, Illuminating Engineering Society, Electric Vehicle Association of America, Municipal Art Society and the Jovian Order.

WALTER NEUMULLER

Mr. Joseph D. Israel, who was last week elected to serve as chairman of next year's convention of the sales managers of the larger Edison illuminating companies, is district manager for the Philadelphia Electric Company. Born at Philadelphia in 1868, Mr. Israel at the age of eighteen was graduated from the Scientific School of the University of Pennsylvania with the degree of B.S. At the end of a post-graduate year in mechanical and electrical courses the university conferred upon him the degree of M.E. in 1887. Joining the staff of the old Edison Electric Light Company of Philadelphia in the same year, he devoted his attention to underground street work and was shortly afterward appointed superintendent of street construction for the company. Later he was appointed assistant to the manager, and then secretary and manager of the company. At the time of the merger of the Edison company with the Philadelphia Electric Company Mr. Israel was appointed district manager of the latter. Mr. Israel has twice been elected general secretary of the Illuminating Engineering Society and is a past-chairman of the Philadelphia Electric Company section of the N. E. L. A. He is a member of the American Institute of Electrical Engineers and of the Franklin Institute of Philadelphia and has presented many papers before these organizations and before the Association of Edison Illuminating Companies.

J. D. ISRAEL

Corporate and Financial

Boise-Payette River Electric Power Company.—Holders of first mortgage twenty-year 6 per cent bonds have been urged by a protective committee composed of Messrs. E. Elmer Foye of E. Elmer Foye & Company, Roger W. Babson of the Boston Statistical Organization, and Henry P. Kendall of the Plympton *Press*, to deposit their holdings with the Old Colony Trust Company, Boston, Mass. These bonds, besides being a first mortgage on the property of the company, are secured by the capital stock of the Capital Electric Light, Motor & Gas Company. The committee states that the property of the latter company has been conveyed for a nominal consideration to the Idaho-Oregon Light & Power Company, which acquired control of the Boise-Payette company through purchase of its entire capital stock, and that unless some steps are taken to reinstate the Capital company in the enjoyment of its franchises and property, the Boise-Payette company would find itself without a distributing system if the bondholders should be compelled to take possession of the property covered by the mortgage securing their bonds. The committee states further that it is informed that to some extent there has been substituted for property of the Capital company used in its distributing system other property to which it should have title, and that the relations between the companies are unsatisfactory in various respects.

Cincinnati (Ohio), Newport & Covington Light & Traction Company.—At the recent meeting of stockholders it was voted to ratify the plan for refunding the $2,000,000 bond issue, due on May 1, 1918, of the Union Light, Heat & Power Company, which owns the properties of the light and traction company. The agreement with the Columbia Gas & Electric Company provides for the refunding of these bonds by a new bond issue at or before maturity. No provision is made for a sinking fund. The agreement also provides that extensions and additions for the Union company property shall be paid for by the issue and sale of stock of the Cincinnati company. In view of the present market price of Cincinnati, Newport & Covington Light & Traction Company stock and other consideration, it was deemed inadvisable to issue further stock for extensions and additions, as repeated issues might tend to depress the price and result in a permanent increase of the outstanding amount, which in time would become too great. The directors therefore agreed with the Columbia company upon a modification of the present contract with that company to provide a permanent plan of financing which will refund bonds of the Union company and provide for extensions and additions through a new bond issue and for the establishment of a sinking fund to retire all bonds at or before maturity. The amount of the new issue is $5,000,000. The bonds will mature in fifty years and will bear 5 per cent interest. There will be issued now only the amount necessary to refund $1,608,000 outstanding bonds. Such additional amounts will be put out each year as are necessary to pay for extensions and additions. These, it is estimated, will average from $50,000 to $75,000 annually. At this rate the proposed issue will take care of necessary extensions and additions for fifty years. The Columbia company will guarantee the creation and maintenance of the sinking fund to retire the bonds.

Columbia Gas & Electric Company, Cincinnati, Ohio.—Secretary T. F. Wickham bought $2,501,500, par value, of the company's bonds at 69.95, with $1,750,000, which was found to be available for this purpose out of the proceeds of a recent transaction with the East Ohio Gas Company.

International Steam Pump Company, New York, N. Y.—The reorganization plan which has been submitted to the security holders for their approval proposes a new company to acquire the existing properties. Under the plan for the new company there will be created $5,639,063 of class A 7 per cent cumulative preferred stock, to be disposed of at par to the holders of 7 per cent preferred stock of Henry R. Worthington to the value of $2,000,000, and also at par to the holders of the company's common stock upon making a cash payment of $12.50 per share, to the holders of the company's preferred stock upon making a light cash payment of such amount as is required in respect of non-participating International common stock, and to the underwriters upon

making payments not provided for by stockholders to the total amount of $3,639,063. Syndicate managers have the right at any time within six months from issue to buy from the holders of preferred stock of Henry R. Worthington the new stock at 105 and accrued dividends. The new company shall create $10,126,892 of class B 6 per cent preferred stock cumulative after three years, to be issued at par to the holders of the company's bonds for their principal and interest. Common stock will be issued to holders of preferred stock for 34 per cent of present holdings and to holders of common stock for 17 per cent of present holdings, a total value of $6,878,625; to holders of International bonds for 35 per cent of principal and accrued interest, $3,544,412; to the syndicate managers in consideration of the underwriting of a cash requirement, $1,000,000, and reserve in treasury to be used for securing the aid of new interests in the management of its new company, etc., $1,500,000. Under the plan the new company will be organized if possible in a state where no par value is required for common stock. The new company will guarantee the payment of the principal of the new first mortgage bonds of the Holly Manufacturing Company, the principal of the new bonds to be 90 per cent of the present bonds. The total liability for principal on this guarantee will not exceed $442,890. The new company's cash requirements will amount to $3,600,000, which will be provided by the payments of $12.50 per share by the preferred and common stockholders of the company participating in the plan. Holders of International bonds will receive for each $1,000 bond with the $83.33 accrued interest $1,083.33 of class B preferred stock and $379.17 in common stock. No provision is made for the assumption of the first mortgage 5 per cent bonds of the Jeanesville Iron Works Company to the value of $200,000 and the $528,104.21 of preferred cumulative 8 per cent stock of the Blake & Knowles Steam Pump Works. Messrs. William Salcmon & Company, the syndicate managers, have secured underwriters for the cash requirement plan up to $3,889,063 who have agreed to make the payments of $12.50 for each share of stock which are not made by the stockholders and also to provide $250,000 in cash which shall be distributed from the process of any sale to such of the International bondholders as do not participate in the plan. The underwriters shall receive a cash commission of 5 per cent on such aggregate obligations, and the syndicate manager shall receive $1,000,000 common stock of the new company. In framing the plan of reorganization the committee has endeavored to remedy the defects in the financial structure and organization of the company which brought about the receivership. The more important of these defects were the following: (1) Inadequate working capital resulting primarily from the payment of too liberal dividends on a heavy capitalization; (2) excessive fixed charges in the way of interest and sinking-fund payments on the company's bond issue and interest and dividends upon underlying bonds and preferred stocks; (3) restrictions in operations resulting from the existence of subsidiary companies having securities outstanding and owning factories, thus preventing complete consolidation in manufacture; (4) the lack of an executive management having a direct financial interest in the success of the company; (5) the failure of the company, partly through lack of working capital and declining credit, and partly through lack of a progressive and energetic policy, to make improvements in its products and manufacturing methods. After allowing for depreciation, obsolete inventories, bad debts and other deductions, the value of the property of the company and its subsidiaries to a going concern as of Sept. 30, 1914, without allowance for patents or good will, was reported to be as follows:

Plants	$10,537,000
Investments (chiefly in English companies)	1,181,000
Trusteed cash	90,000
Cash, inventories, accounts and bills receivable, work in progress and other current assets, net	7,481,000
Total	$19,289,000

From Sept. 30, 1914, to July 31, 1915, under the receivership, orders booked were reported as $7,630,000, the orders for May, June and July being reported as approximately $1,000,000, $940,000 and $1,200,000 respectively. The advantages of the plan to which the committee wishes to call particular attention are the following: (1) The new money to be furnished by the stockholders, or, to the extent of their failure to participate, by the underwriters, is deemed to be adequate to provide for such of the underlying securities as it may be advisable to retire and also to provide sufficient working capital to enable the company to deal with a substantially larger volume of business than it has hitherto done. (2) The new capital will also provide for the considerable expenditures required to bring the company's factories and manufacturing facilities up to date and for the redesigning of the company's products which is necessary for carrying out a progressive manufacturing policy. (3) The capitalization of the new company has been confined to what may fairly be regarded as the value of the enterprise as a going concern. (4) Provision is made for reducing or eliminating the subsidiary organizations and effecting the needed consolidation of operations. (5) While it seemed necessary to create for the new money a security, class A preferred stock, prior to that issued to the bondholders, class B preferred stock, the two classes of preferred stock will be on a parity, except as to the rate of dividend, after the company shall have paid for three consecutive years full dividends on both. (6) As the company will have no bonded debt, except such liability as it may assume on two small underlying issues aggregating $692,100, it will be in a position to face periods of depression without anxiety, and it is believed that the added strength of its position due to the absence of a considerable fixed charge will enable it to pay full dividends upon the preferred stocks more readily than it could earn interest at a lower rate upon an equal amount of bonds. Through their participation in the common stock the bondholders are given a substantial interest in the future growth of the enterprise. (7) Provision for securing a management having a direct interest in the financial success of the new company has been made by reserving under the plan $1,500,000 new common stock. Mr. C. Philip Coleman, who is joint receiver of the company with Mr. G. M. P. Murphy, stated that there was no relation between the plan for reorganization and the company's receipt of orders for munitions of war. While Mr. Coleman confirmed the report that the company had accepted war orders, he declined to state the size of the contracts.

Nevada-California Power Company, Denver, Col.—The annual report states that in the future the results of the operations will be merged in the combined report of the Nevada-California Electric Corporation, a holding company, which will become the owner of outstanding stock of the Nevada-California Power Company, Southern Sierras Power Company, Interstate Telegraph Company, Bishop Light & Power Company, Corona Gas & Electric Light Company and Hillside Water Company. In financing the cost of increases in the generating capacity and extensions of transmission and distributing lines, new capital will be secured by the sale of bonds equal to 85 per cent of the value of enlargements and extensions. Mr. Delos A. Chappell, the president, says: "Less than 2 per cent of the total investment of our companies is within the corporate limits of any municipality, and practically all of our franchises are indeterminate or extend for practically fifty years. Future development of the business will consist largely in the construction of secondary and distributing feeder lines, bringing business at various points along the main-trunk transmission system. Besides this there will be constructed from time to time additional generating plants. The combined earnings and expenses for the years ended Dec. 31, 1913 and 1914, follow:

	1913	1914
Gross earnings	$1,484,971	$1,566,036
Expenses and taxes	791,114	806,217
Operating profit	$693,857	$759,819
Bond interest, etc., less other interest	318,317	353,742
Profit and loss adjustments	16,669*	3,824†
Earned surplus	358,871	409,901

*Debit. †Credit.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—Up to the close of business on Aug. 17 stockholders had subscribed for $18,237,000 new convertible bonds of the $18,695,000 offered for subscription at 105. Under the terms of the agreement the unsubscribed bonds, $485,000, will go to the holders of the old bonds. Of the total subscriptions payment was made in full for $16,423,000 of bonds. On the balance the first installment was paid.

Manufacturing and Industrial

The Walter A. Zelnicker Supply Company, St. Louis, Mo., dealer in used electrical machinery, has purchased the stock of the Bintliff Supply Company.

The Fuller Electrical Appliance Company, Wellesley, Mass., was recently formed and is engaged in the manufacture of electric specialties. Mr. F. A. McClaskey is president of the company. Dr. Louis D. H. Fuller and Messrs. M. D. Maher, C. L. Maher and H. A. Weitz are also members of the firm.

W. R. Ostrander & Company, 22 Dey Street, New York City, have announced that the National Board of Fire Underwriters has approved the Ostrander bell for service on 50-volt to 250-volt circuits. This bell is of the vibrating type and is manufactured in sizes from 2½ in. to 24 in. It is especially designed for fire-alarm, railroad and school signals. The Ostrander company will mail its electric-bell circular upon request.

The Smith-Brown Battery Works, Bloomington, Ind., have been purchased, it is announced, by Messrs. F. R. Allison and Carl Fisher of the Indianapolis Presto-lite Company. It is understood that the plant will be removed to Indianapolis and that Prof. O. W. Brown, inventor of the Smith-Brown battery system and a member of the faculty of the State University at Bloomington, Ill., will go to Indianapolis as head of the company.

Good Season for Lamp Manufacturer.—The Banner Electric Division of the National Lamp Works of the General Electric Company, Youngstown, Ohio, it is reported, has noted a great improvement in its business since the first of the year. The increase in orders since Jan. 1 is said to have been about 35 per cent, and present prospects indicate that 1915 will be a much better year than 1914, although it may prove hardly so good as 1913. The company is obtaining most of its tungsten for lamp filaments from Colorado. Before the war a considerable amount of this material was imported from Germany.

The Molby Boiler Company, 39 Cortlandt Street, New York, which was recently formed, is engaged in the manufacture of down-draft, magazine-feed boilers for low-pressure heating, burning the cheaper grades of fuel. The company operates a plant at Port Chester, N. Y. Mr. E. C. Molby, formerly with the Pierce, Butler & Pierce Manufacturing Company for twenty years, is president of the company; Mr. Martin Behrer, owner of the firm of Behrer & Company of 81 Beekman Street, New York, is treasurer, and Mr. A. M. Behrer, also with Behrer & Company, is secretary and assistant treasurer.

Strike Efforts Futile at Sturtevant Plant.—Efforts of labor leaders to start a strike at the factory of the B. F. Sturtevant Company, Hyde Park, Mass., last week resulted in a fiasco, only seven out of 1200 employees responding to the call to leave the shops. It was stated at the plant that about 1 per cent of the force is normally absent. Former Governor E. N. Foss of Massachusetts, principal owner of the plant, in a vigorous letter to the State Board of Conciliation and Arbitration, denied the existence of any dispute in the factory between himself and his employees and averred that walking delegates were the instigators of the attempted tie-up.

Bullock Plant Not Under Bethlehem Control.—A denial has been issued by the management of the Bullock Electric Company of Norwood, near Cincinnati, Ohio, now owned by the Allis-Chalmers Company, of the rumor that the plant had been acquired by the Bethlehem Steel Company. It is stated that a clause in the sale provides that the Allis-Chalmers Company shall not dispose of the plant. It is understood, however, that the Bethlehem Steel Company has sublet to the Allis-Chalmers Company a considerable amount of the work to be done under some of its large war contracts, and that the company's plants in Milwaukee and Norwood have for some time been actively engaged on this work.

The National Lighting Products Company, a recently organized Pennsylvania corporation, in which Messrs. Samuel Hamilton, Jr., A. H. King, Walter McFarland, F. C. Murdock and E. A. Richter of Pittsburgh are interested, has recently let contracts for a two-hundred-thousand-dollar four-story building to be erected at Forbes Street and Grant Boulevard, Pittsburgh, Pa. Here the company will display and engage in the business of selling electrical signs and fixtures of all kinds, including changeable-letter signs, illuminated art designs, projecting clocks, etc. Special efforts will be made to obtain South American trade. Part of the second and all of the third and top floors of the building will be devoted to manufacturing purposes. Elaborate plans have been developed for flood-lighting the building and producing novel lighting effects on the white-tiled walls forming the upper two stories of the building.

The Goulds Manufacturing Company, Seneca Falls, N. Y., manufacturer of pumps and hydraulic machinery, announces that instead of having its entire sales organization in charge of a single executive, the selling work has been divided and is now directed jointly by Mr. R. E. Hall, former manager of the Boston office, and Mr. W. E. Dickey, former manager of the New York office, Mr. A. H. Whiteside, the former sales manager, having resigned. Mr. Dickey, who still retains his headquarters at the New York office, has charge of all business in the Southern, Southwestern and Southern Pacific States, including the territories of the New York Pittsburgh, Atlanta and Houston offices. Mr. W. P. Hopper succeeds Mr. Dickey as New York manager, and Mr. C. W. Fulton, formerly works manager, has been appointed manager of the Boston office. A Pittsburgh office has recently been opened in the Henry W. Oliver Building under the management of Mr. H. H. Henderson, who has been representing the company in northern West Virginia and southeastern Ohio. Mr. E. C. Wayne, formerly of the Seneca Falls (N. Y.) office, has been appointed assistant manager of the Pittsburgh office.

Busy Season for Portable Electric Lamps Coming Soon.—Mr. B. A. Rooks, sales manager for the Aladdin Lamp Corporation, 52 Vanderbilt Avenue, New York, in conversation with a representative of the ELECTRICAL WORLD remarked that the summer is a rather dull season for portable lamps, but that the business begins to pick up in September and has a rising trend until well into the winter months. The Aladdin corporation is specializing in the "Vanitie" portable lamp, which was described in the ELECTRICAL WORLD of March 20, 1915. This lamp can be adjusted in a number of different ways and adapted to a variety of uses. Mr. Rooks said that it is especially convenient for a man who is shaving or a woman who is dressing. It can also be used advantageously as a piano lamp and for various purposes in the office. The Aladdin Lamp Corporation has divided the country into some fifty selling districts, each of which will be in charge of a sales agent. The company will also send a number of salesmen and demonstrators around the country to instruct dealers regarding the salient features of the lamp. Various selling helps, such as electrotypes for newspapers, window posters, circulars with selling instructions and "animated" lantern slides, will be supplied to the dealers. The lantern slides are a new advertising feature. With the aid of a screen of parallel bars three exposures are made on one plate. The slide is so arranged that by moving it rapidly from side to side the image on the screen is varied.

NEW YORK METAL MARKET PRICES

	Aug. 10 Selling Prices Bid	Aug. 10 Selling Prices Asked	Aug. 17 Selling Prices Bid	Aug. 17 Selling Prices Asked
	£ s d		£ s d	
Copper				
London, standard spot*	69 0 0		67 2 6	
Prime Lake	17.62½	to 17.87½	16.75	to 17.00
Electrolytic	17.37½	to 17.62½	16.50	to 16.62½
Casting	16.50	to 16.75	15.87½	to 16.12½
Copper wire base		19.00†		18.00†
Lead		4.50		4.50
Nickel	50.00	to 52.00†	50.00	to 52.00†
Sheet zinc, f.o.b. smelter		21.00†		17.00†
Spelter, spot	14.25	to 14.75†	11.75	to 12.25†
Tin, straits		34.50		34.37½
Aluminum, 98 to 99 per cent	32.00	to 34.00	33.00	to 35.00

*OLD METALS

Heavy copper and wire	14.00	15.75
Brass, heavy	9.00	10.50
Brass, light	7.50	9.00
Lead, heavy	3.50	4.12½
Zinc, scrap	6.00	9.50

*COPPER EXPORTS

Total tons to Aug. 17 8,963

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Johnson County Light & Power Company of Knobnostor, Mo., has been chartered with a capital stock of $5,000 by S. A. Kelley, Guy C. Cooley and James Ennis.

The Botetourt Water Power Company of Roanoke, Va., has been incorporated with a capital stock of $5,000 to construct a power plant. The officers are: J. W. Hancock, president; H. D. Vickers, secretary and treasurer, both of Roanoke.

The Hopewell Electric Light & Power Company of Hopewell, City Point, Va., has been incorporated with a capital stock of $50,000 to construct a light and power plant. The officers are: W. H. Hoyt, president; H. J. Ingram, Jr., vice-president, and C. T. Morris, secretary and treasurer, all of Hopewell.

New Industrial Companies

The Allen Electrolytic Cell Corporation of Portland, Maine, has been incorporated with a capital stock of $50,000 to manufacture and deal in chemicals, articles, etc., used in construction of hydroelectric, electrochemical, etc., plants.

The Thomas J. Radley Company of New York, N. Y., has been chartered with a capital stock of $5,000 for the purpose of doing a general engineering, steam, electrical and metal workers' business. The incorporators are T. J. Gannon, C. and T. J. Radley, 723 Eighth Avenue, New York, N. Y.

The United States Cutting Machine Sales Company of New York, N. Y., has been incorporated by N. Komow, S. Philips and M. I. Garshells, 1271 Hoe Avenue, the Bronx, New York. The company is capitalized at $10,000 and purposes to manufacture and deal in electric cloth-cutting machines.

The Telelectric Company of Massachusetts has filed articles of incorporation under the laws of the State of New York with a capital stock of $400,000. The company manufactures and deals in electric, automatic and musical instruments. William Shillaber, Jr., 73 Dey Street, New York, N. Y., is representative of the company.

Trade Publications

Conduit Tool.—The Fey Specialty Company, 71 Brainard Street, Detroit, Mich., has issued a circular on its automatic grip hickey, a tool designed for use in conduit installations.

Electric Washing Machine.—The Capital Electric Company, Insurance Exchange Building, Chicago, Ill., has prepared an illustrated booklet entitled "The Capital Safety-First Electric Washer."

Automatic Time Switches.—Bulletin No. 33, prepared by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass., describes and illustrates several types of automatic time switches.

Outdoor Sign Fixtures.—The Thos. Cusack Company, Chicago, Ill., has just issued a catalog of its supply department which contains information on various types of outdoor electric-sign installations.

Safety for Employees.—The Bureau of Safety, Inc., 72 West Adams Street, Chicago, Ill., has issued a booklet which contains an outline on the purposes, organization and the general services of the society.

Small Induction Motors.—The Robbins & Myers Company, Springfield, Ohio, has issued an illustrated folder containing information on its type K induction motor with ratings varying from 0.25 hp. to 20 hp.

Electrical Instruments and Appliances.—The Western Electro-Mechanical Company, Oakland, Cal., has issued a catalog on its instruments and appliances for electrical laboratories and central stations.

Electric Tachometers.—Bulletins No. 110 and No. 111, published by the Electric Tachometer Company, Perry Building, Philadelphia, Pa., describe and illustrate several magneto-operated tachometer outfits.

Lighting Fixtures.—The Beardslee Chandelier Manufacturing Company, Chicago, Ill., has prepared several illustrated plates on its ornamental lighting fixtures, which are designated as G-5-1 to G-5-6 inclusive.

Portable Electric Tools.—The Stowe Manufacturing Company, Binghamton, N. Y., has issued Bulletin No. 400, which contains information and illustrations on various types of its electrically operated portable tools.

Tubular Lamp for Photographic Enlarging.—The Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J., has issued Bulletin No. 61, on its M-shaped tubular lamp outfit for enlarging photographs.

High-Tension Equipment.—The Delta-Star Electric Company, Chicago, Ill., is distributing Descriptive Leaflet No. 750, showing typical installations of high-tension air-brake switches designed for pressures up to 66,000 volts.

Small Generating Plants.—The Electric Storage Battery Company, Philadelphia, Pa., has issued the sixth edition of its "Handbook H L," which contains information on low-voltage plants for use with "chloride accumulators."

Wiring Devices.—Bulletin No. 1000-C, which includes Bulletins No. 1000-A and No. 1000-B, was issued July 15 as a supplement to Catalog No. 1000 by the Crouse-Hinds Company, Syracuse, N. Y., and contains information on its "condulets."

Engine-Driven Generators.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has prepared Bulletin No. 1093 on its engine-driven direct-current machines. These machines are of the commutating-pole type with ratings of 2000 kw.

Protective Devices.—The Metropolitan Engineering Company, Forty-second Street Building, New York, has prepared for the American Museum of Safety, 18 West Twenty-fourth Street, New York, a bulletin on "Murray Protective Devices for Central Stations."

Small Generating Plants.—"Lighting Country Homes" is the subject of an illustrated bulletin issued by the Suburban Lighting & Gas Engine Company, Toledo, Ohio, which describes and illustrates several types of small gasoline-engine-driven generating plants.

Tungsten Lamps.—Multiple tungsten lamps with ratings of from 10 watts to 1000 watts for operation on 105 volts to 125 volts and 220 volts to 250 volts are the subject of Bulletin No. 13E, published by the National Lamp Works of the General Electric Company, Cleveland, Ohio.

Electric Devices and Appliances.—The Western Electric Company, New York, has recently prepared catalogs and bulletins on its electrically operated hammers, electric lanterns, electric motor pump, stationary and portable vacuum cleaners and automobile and ignition supplies.

Oil Engines.—The Bolinders Company, 30 Church Street, New York, has issued several attractively illustrated catalogs on its large-sized oil engines for operating electric generators. These engines are manufactured by the J. & C. G. Bolinders Mek. Verkstads A. B., Stockholm, Sweden.

Apparatus for Protection Against Surges.—The General Electric Company of Great Britain, 67 Queen Victoria Street, London, E. C., England, has prepared an attractively illustrated catalog entitled "The Condenser System of Protection Against Surges." The catalog describes the Moscicki condenser and the Giles valve.

Electric-Railway Equipment.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Circular No. 1550, on its 1500-volt direct-current substation equipment, Special Publication No. 1549, on "Heavy Traffic Centers," and a number of descriptive leaflets on its railway equipment and power-house and substation apparatus.

Electrical Apparatus.—The General Electric Company, Schenectady, N. Y., has prepared Bulletin No. Y-679, which supersedes Bulletin No. Y-548, on street-lighting brackets and center-span fixtures for tungsten lamps; Bulletin No. Y-681, which supersedes both Bulletins No. Y-527 and No. Y-529, on its "Novalux" street-lighting units for tungsten series lamps; Bulletin No. 44,090, on railway substations; Bulletin No. 46,110, on electrostatic voltmeters, and Bulletin No. 47,406, on its type F form K-20 oil switches for operation with pressures up to 2500 volts.

Construction News

New England

BAR HARBOR, ME.—Within the next six months the Bar Harbor & Union River Pwr. Co. expects to purchase electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners and washing machines, to meet demands. L. A. Leach is superintendent.

KINGFIELD, ME.—The Public Utilities Commission has granted the Huse Spool & Bobbin Co. of Kingfield permission to sell its electric plant, holdings and franchise to the Kingfield Lt. Co.

PORTLAND, ME.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 2, for construction complete, including mechanical equipment, lighting fixtures and grading, of the steerage barracks and storehouse for the United States quarantine station at Portland, Maine. Drawings and specifications may be obtained at the above office or from the custodian of site at Portland.

CHICOPEE, MASS.—The Fisk Rubber Co. of Chicopee is reported to be planning to build a five-story mill (600 ft. by 110 ft.) to be equipped with motor-driven machinery and to cost about $300,000.

STERLING, MASS.—The city of Sterling is contemplating extending the municipal electric-light and power service to Lake Washacum. The cost is estimated at $11,000.

Middle Atlantic

ATTICA, N. Y.—Within the next three months the Attica Wtr., Gas & El. Co. expects to purchase one 75-kva., two-phase, 60-cycle, 1100-volt generator, with exciter and necessary ammeters, voltmeters and switches. R. W. Harris is manager.

BABYLON, N. Y.—The Public Service Commission has authorized the Long Island Ltg. Co. to take over the Babylon El. Lt. Co. and to issue $175,000 in bonds and $125,000 in capital stock. The proceeds are to be used to acquire the property, including franchises, etc., of the Babylon Co.

FILLMORE, N. Y.—Within the next six months the Genesee Valley Pwr. Co. of Fillmore expects to purchase one 150-hp. oil engine.

GENEVA, N. Y.—The Central New York Gas & El. Co. of Geneva expects within the next three months to erect an outdoor substation with an output of 1200 kva., equipped with three 400-kva., 13,200/2300-volt transformers, at Geneva. The company will also erect 10 miles of 13,000-volt transmission line between Geneva and Seneca Falls, 4 miles to be erected on Archbold-Brady A frames and the remainder on existing wood poles. Material for transmission line has already been purchased. L. C. Reynolds is general superintendent.

GOUVERNEUR, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 10, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Gouverneur. Drawings and specifications may be obtained at the above office.

MINEOLA, N. Y.—Bids will be received at the office of the Board of Supervisors of Nassau County, Court House, Mineola, until Aug. 26 for furnishing and installing lighting fixtures for the additions to the Nassau County Court House, in accordance with plans and specifications prepared by William B. Tubby, architect, 81 Fulton Street, New York. The sum of $7,000 has been appropriated for this work. George M. Goodale is clerk of board.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Municipal Building, New York, N. Y., until Aug. 23 for furnishing one interruptionless X-ray generator. Blank forms and further information may be obtained at the office of the contract clerk of department, Municipal Building.

NEW YORK, N. Y.—Bids will be received by Bellevue and Allied Hospitals, Department of Correction, Fire Department, Department of Public Charities and Department of Water Supply, Gas and Electricity, Room 1230, Municipal Building, New York, until Aug. 27 for furnishing pipe, pipe fittings, etc., miscellaneous engineers' and machinists' supplies, electrical fixtures and supplies, drafting and engineering tools, instruments and supplies, etc. Blank forms and further information may be obtained at Room 1226, Municipal Building.

NIAGARA FALLS, N. Y.—A new plan has been submitted to the joint legislative committee by Peter A. Porter to harness Niagara Falls. The proposed plan provides for the construction of a 90-ft. dam in the gorge above Queenstown. There is a drop of 100 ft. from the foot of the fall to the site of the proposed dam.

OSWEGO, N. Y.—A committee has been appointed by the City Council to engage an engineer to prepare plans and supervise the construction of a water-power plant at High Dam on the Oswego River.

TONAWANDA, N. Y.—The Council has decided to install a new street-lighting system.

DELTA, PA.—The Delta Wtr. Pwr. Co. is planning to build a concrete breast dam this season, increasing head of 6 ft. to 9 ft. J. H. Stubbs is president.

HARRISBURG, PA.—The Public Service Commission has approved the incorporation of the following light and power companies, which will be operated by the Eckels Lt., Ht. & Pwr. Co. of Crawford County: Fairview Township, Girard Township, Conneaut Township, Cranesville Borough, Summer Hill Township, Spring Township, all of Erie County; Paint El. Co. of Paint, and Scalp Level El. Co. of Scalp Level, Cambria County.

MEDIA, PA.—The borough of Media will install in the municipal electric light and water plant in about two months an additional generating unit consisting of an engine and generator with a rating of about 100 kw. and new switchboard. Contracts have been awarded for the construction of a 200,000-gal. sedimentation basin, improving present mechanical pressure filters, and also for the installation of a 1,000,000-gal. pumping engine with necessary piping and water-testing plant, to the Eastern Construction Co. of Philadelphia. P. E. Ahern is manager.

MONACA, PA.—The Town Council has decided to notify the Monaca El. Co. that the town has decided to take over the plant and equipment of the company at the end of a year. A 15-year franchise will expire in 1916.

PITTSBURGH, PA.—Bids are being asked by the Board of Public Education, Fulton Building, Pittsburgh, for electrical work to be installed in five public schools. For further information address George W. Gerwig, secretary.

PITTSBURGH, PA.—The Public Service Commission has approved the following contracts: The Duquesne Lt. Co. and the city of Pittsburgh for the installation of numerous lamps; the Penn El. Ser. Co. and the county of Somerset for operating and maintaining street-lighting system; the West Penn Ltg. Co. and the borough of Houston for the installation of a power plant; the Westmoreland El. Co. and the borough of Youngwood for operating a street-lighting system; the Central District Tel. Co. and the borough of Monoca for installing and operating a telephone system.

BURLINGTON, N. J.—The Council has engaged W. E. Temple, electrical engineer, of Philadelphia, Pa., to take charge of changing the motive power of the drainage system from steam to electricity. The cost is estimated from $6,000 to $7,000.

CAMDEN, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 14 for the installation of an electric freight elevator, etc., in the United States post office and custom house at Camden, N. J. For details see proposal columns.

CEDAR GROVE, N. J.—Bids will be received by the lighting commissioners of the township of Cedar Grove until Aug. 23 for furnishing for one year from Sept. 1, 1915, 40 (more or less) 32-cp. lamps for street lighting.

MADISON, N. J.—The contract for installing the ornamental lighting system at St. James Park has been awarded to the Central Station Equipment Co., 114 Liberty Street, New York, N. Y.

PARKERSBURG, W. VA.—The Kanawha Trans. & El. Co., successor to the Parkersburg, Marietta & Interurban Ry. Co., is erecting a new power plant to take the place of two old plants, one situated at Parkersburg, W. Va., and one at Marietta, Ohio. The new plant will be equipped with two 2000-kva. and one 1000-kva. General Electric steam turbo-generator; also three 500-kw. motor-generator sets for street-railway service; three 500-kva. transformers, 2200/22,000 volts, connecting its 22,000-volt transmission line between the two cities, other transformers, switchboard, etc., all General Electric make. As this plant is a mile distant from the old Parkersburg plant, considerable transmission line will be needed to connect the new plant with the old system. A change will be made from two-phase to three-phase distribution. Contracts for material have been placed. C. C. Gallaher is acting manager.

WINCHESTER, VA.—The city of Winchester is considering municipal ownership of the electric-lighting system.

WASHINGTON, D. C.—Bids will be received until Aug. 24 for furnishing two motor-driven tractors and two motor-driven combination chemical hose wagons for the use of the Fire Department, District of Columbia.

WASHINGTON, D. C.—Bids will be received at the Department of the Interior, Washington, D. C., until Aug. 24 for furnishing material and rewiring the basement rooms and corridors of the General Land Office Building, Washington. Plans and specifications may be obtained upon application to the chief clerk of the department.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 31 for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 8665—20 electrically illuminated stadimeters. Boston, Mass., Schedule 8677—8000 lb. phosphor bronze. Bids will also be received at the same place until Sept. 7 for the following supplies: East and West, Schedule 8671—miscellaneous globes and prismatic reflectors; Schedule 8670—miscellaneous water-tight attachment plugs and tips for miscellaneous water-tight attachment plugs; Schedule 8669—miscellaneous weatherproof sockets; Schedule 8672—miscellaneous cotton insulating tape, miscellaneous rubber insulating tape. Bids will also be received until Sept. 7 as follows: Washington, D. C., or Pensacola, Fla., or f.o.b., Schedule 8664—27 motors for aeroplanes. Mare Island, Cal., Schedule 8659—two direct-current turbo-generator sets. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 17,861—A representative of a firm in the Netherlands states that he desires to receive samples and quotations on the following goods: Electric, gas and oil lamps; brass tubes, brass chains, and brass double parts for making lamps. The New York City address of the representative may be had on application to the above bureau or its branches. No. 17,862—A representative of a Norwegian firm, who at present is in New York City, states that he desires to establish commercial relations with American manufacturers and exporters of pocket flashlights, electric push-buttons, etc., thermometers for hospital use, field glasses, etc. No. 17,964—A merchant in the Netherlands informs an American consular officer that he desires to purchase electrical and optical goods, electric pocket lamps, etc. No. 17,898—A merchant in Spain informs an American consular officer that he desires to receive catalogs and full information relative to stationary electric motors for pumping water. Correspondence should be in Spanish. Further information may be obtained at the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

North Central

DETROIT, MICH.—A power house, 80 ft. by 170 ft., will be erected on Martin Avenue, south of Michigan Avenue, for the parish of Our Lady of the Angels.

DURAND, MICH.—Within the next six months the water and light commission expects to purchase a 250-kva., three-phase, 60-cycle, 2200-volt generator (directly connected). H. F. Rosencrans is superintendent.

MIDLAND, MICH.—Surveys and other preliminary work have been completed for the proposed hydroelectric development of the Tittabawassee Pwr. Co. The company has purchased 11,396 acres and has obtained options on 30,000 more in connection with the project. The first dam when completed, it is said, will develop 12,000 hp. Frank I. Wixom is local manager.

BUCYRUS, OHIO—The Bucyrus Lt. & Pwr. Co. has practically completed its new steam generating station, equipped with a 600-kw. General Electric turbine and switchboard, Westinghouse Leblanc condensers, Wickes boilers, stokers, etc., at a cost of about $50,000. A. G. Moser is manager.

CINCINNATI, OHIO—The Board of Control has awarded a contract for installing a police signal system in connection with the fire-alarm telegraph system to the Western Electric Co., at $24,588. The new system is to take the place of the present arrangement with the Cincinnati Tel. Co.

CLEVELAND, OHIO.—Contracts have been awarded by the city of Cleveland for 630 lamps to be used in the business district. Energy to maintain the lamps will be supplied by the municipal electric plant.

CLEVELAND, OHIO.—A certified copy of the city ordinance directing the Cleveland El. Illg. Co. to lay heating mains to the new city hall has been served on the company. Owing to the expense involved in extending the mains the company objects to furnishing the service at the rate fixed by the city.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until Aug. 25 for electric wiring for the Division Avenue pumping station. Specifications may be obtained of the commissioner of water, 413 Superior Avenue, City Hall.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until Aug. 25 for furnishing and installing the standard lighting fixtures in the new city hall building. Plans and specifications may be obtained at the office of J. Milton Dyer, 825 Cuyahoga Building, Cleveland, architect, upon deposit of $15, of which $8 will be refunded upon return of plans.

COSHOCTON, OHIO—The Coshocton Lt. & Htg. Co. is installing a new 500-hp. (Stirling type) Babcock & Wilcox boiler, new feed-water heater and feed pump. The company has recently closed a contract with the McClurg Rubber Co. of Coshocton for a 425-hp. connected load in synchronous and induction motors. The Coshocton Glass Co. has increased its power requirements by two 75-hp. induction motors. C. H. Howell is local manager.

FOREST, OHIO — The Council has granted the Hardin-Wyandot Ltg. Co. of Kenton a franchise to supply electricity in Forest and has also awarded the company a ten-year contract for street-lighting.

HAMILTON, OHIO.—Plans are being considered for the installation of a new ornamental lighting system (cluster lamps) on Main Street, wires for which will be installed while the street repairs are being made.

LORAIN, OHIO—Bids will be received at the office of D. D. Lewis, director of public service, until Aug. 25 for furnishing energy (alternating current) for street-lighting and domestic lighting and power purposes for a period of one year.

MANSFIELD, OHIO—Under the new 10-year contract recently awarded the Mansfield Ry., Lt. & Pwr. Co. by the City Council, the company will install a new street-lighting system, consisting of 1000 type "C" tungsten lamps of 100 cp., these to be erected on brackets and center-suspension construction and maintained by overhead wires; also 202 600-cp. tungsten lamps erected on single standards (furnished by the Union Mfg. Co.), maintained by underground wires. S. A. Foltz is manager for the receiver.

MARBLEHEAD, OHIO—Within the next six months the Marblehead Pwr. Co. expects to purchase equipment for street-lighting, consisting of 75 series tungsten street lamps. G. W. Lapp is electrical engineer.

MARION, OHIO.—The City Council has authorized the director of public service to enter into a contract with Eli M. West, receiver for the Columbus, Delaware & Marion Ry. Co., for supplying electricity for 44 cluster-lamp standards, to be erected on West Center Street.

MAUMEE, OHIO.—Bids will be received by the Board of Trustees of Public Affairs of Maumee until Aug. 25 for construction of water-works system, including pumping station, well house, two motor-driven deep-well pumps, capacity each 75 gal. per minute; three motor-driven force pumps, capacity 350 gal. per minute; reinforced-concrete reservoir; elevated steel tank, 60,000 gal. capacity, on 110-ft. steel tower; cast-iron pipe and castings. Separate proposals will be received for several parts of the works and for the entire work. Thomas N. Dowling is clerk.

SALINEVILLE, OHIO.—The Salineville El. Lt., Ht. & Pwr. Co. has recently purchased a 100-kw. Westinghouse alternating-current generator. P. S. Hart is superintendent.

TROY, OHIO.—The contract for the addition to court-house lighting and heating plant (61 ft. by 38 ft.) has been awarded to Grimes & Thompson of Piqua, at $4,948.

WOOSTER, OHIO—Preparations are being made by the Wooster El. Co. for the erection of a transmission line from Wooster to Smithville to supply electrical service there. The company has been awarded a street-lighting contract in Smithville and will establish a 24-hour service. The town of Madisonburg, it is reported, is negotiating with the company to furnish electricity in that village. The farmers residing along the transmission line are also asking for lighting service.

FORT THOMAS, KY.—Proposals have been submitted by the Union Lt., Ht. & Pwr. Co. of Covington for the electric, gas and water franchises for the town, including street-lighting, on which a bid of $23 each for 200 lamps was made. If the proposals are accepted, the company will do considerable new construction work.

LOUISVILLE, KY.—A company is being organized by local business men to take over and rebuild the Holloway tobacco warehouse on A Street. The proposed plant will be operated by electricity.

HUNTINGDON, IND.—Plans, it is reported, have been approved by the Board of Public Works for 74 new lamp standards to be erected on Jefferson Street.

JEFFERSONVILLE, IND. — Contracts have been signed between the city of Jeffersonville and the United Gas & El. Co. for changing over the street-lighting system from arc lamps to inclosed nitrogen-filled tungsten lamps, ranging from 250 cp. to 400 cp. in the business district and 80 cp. in the outlying districts. The number of the poles will be doubled.

SHOALS, IND.—The installation of an electric-light plant and water-works system (combined) in Shoals is reported to be under consideration.

ELIZABETH, ILL.—The Elizabeth Lt. & Pwr. Co. has entered into a contract with the Interstate Lt. & Pwr. Co., a subsidiary of the Northern States Pwr. Co. of Chicago, to furnish electricity to operate its system for a period of twenty years.

KANKAKEE, ILL.—The Board of Supervisors of Kankakee County is investigating the feasibility of establishing an electric light and power plant to supply electricity for the county buildings.

MARINE, ILL.—The Marine El. Service Co. will soon be in the market for a quantity of line material and transformers, also a 30-kva., three-phase generator. The company's plant was completely destroyed by fire on June 3 and a temporary one was built at once and service resumed June 12. H. F. Neale, 1905 Victor Street, St. Louis, Mo., is purchasing agent.

PEORIA, ILL.—The committee on lights, which has been making investigations as to the feasibility of establishing a municipal electric-light plant, has submitted a report recommending the submission of the proposal to the voters. The cost is estimated at $38,389.

SPARTA, ILL.—Bids will be received by the city of Sparta, Ill., until Aug. 24 for construction of water-works system, including 12½ miles of 2-in., 6-in. and 8-in. water mains, 83 hydrants, 100,000-gal. steel tank and tower, two centrifugal pumps and electric motors, one gas-pumping engine and complete filter plant, capacity 500,000 gal. per day. Plans are on file at the office of W. M. K. Brown, civil engineer, East St. Louis, Ill.

DANE, WIS.—Plans are under way for the installation of a municipal electric-lighting system in Dane. Vaughn, Meyer & Sweet, Majestic Building, Milwaukee, are engineers.

DELAVAN, WIS.—The Burlington El. Lt. & Pwr. Co. of Burlington has secured the right-of-way for the erection of a transmission line from Burlington through Lake Geneva and Elkhart to Delavan. If satisfactory arrangements can be made with the lighting companies in these towns, the line will be built. C. E. Partee is manager.

DURAND, WIS.—The capital stock of the Durand Lt. & Pwr. Co. is reported to have been increased from $35,000 to $70,000.

LODI, WIS.—Plans are being prepared, it is reported, by Vaughn, Meyer & Sweet, electrical engineers, Majestic Building, Milwaukee, for rebuilding the distrbution system of the municipal electric-light plant.

MADISON, WIS.—Plans have been prepared by E. E. Parker, city engineer, for the installation of a new street-lighting system (to cost $18,000), which provide for the erection of 145 ornamental standards mounted with nitrogen-filled lamps of 1000 cp., maintained by underground wires, bids for which were opened Aug. 13.

MILWAUKEE, WIS.—Bids will be received at the office of the lighthouse inspector, Milwaukee, Wis., until Aug. 25 for furnishing two electrical motor-driven air compressors. Further information may be obtained upon application to the above office.

AUSTIN, MINN.—Bide will be received until Sept. 1 by the Independent School District No. 27, Franklin Building, Austin, for construction of an eight-room ward school building, including general contract work, electric wiring, heating, plumbing and ventilation. Kinney & Macomber of Minneapolis are architects.

ELLSWORTH, MINN.—The village of Ellsworth is contemplating the purchase of a 40-hp. engine and a 20-kw., 220/110-volt generator for the municipal electric-light plant. John Boomgarden is superintendent.

ST. PAUL, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Aug. 31 for construction of an addition to the House Economics Building, at the University Farm School, St. Paul, including the general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications prepared by C. H. Johnston, architect, Capital Bank Building, St. Paul. Bids to be submitted separately.

WARREN, MINN.—The contract for additions and improvements to the municipal electric-light plant is reported to have been awarded to J. G. Robertson, 2542 University Avenue, St. Paul.

WINDOM, MINN.—The municipal electric-light plant is being changed over from direct-current to alternating-current system. The work will be completed about Sept. 15, when a day service will be established. A. H. Dickerson is superintendent.

ARLINGTON, IOWA—The citizens have voted to grant a franchise to C. Miller & Sons of Clermont to supply electrical service in Arlington. The transmission line will be extended from Fayette to Arlington.

TIPTON, IOWA—Bids will be received by T. C. Moffit, auditor of Cedar County, at Tipton, until Sept. 2, for construction of a County Home Building at Tipton. Separate bids will be received at the same time for heating, plumbing and electric wiring of said building. Charles A. Dieman & Co. of Cedar Rapids are architects.

CASSVILLE, MO.—The Cassville Mining & Milling Co. is building a new engine room in connection with power house and will install an 80-hp. oil engine and also a 12-hp. engine for pumping. If the new engine proves satisfactory, the steam plant will be closed down. No change will be made in electrical equipment. Contracts have been placed for machinery. J. C. Ault is secretary.

EDGERTON, MO.—The McComas Hydro-Electric Co. of Edgerton is reported to have authorized an additional bond issue of $35,000, the proceeds to be used to equip its power plant. The company proposes to supply electricity in Edgerton and neighboring towns.

FULTON, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 7 for the construction of United States post office, complete, at Fulton, Mo. For further information address James A. Wetmore, acting supervising architect.

NOVINGER, MO.—The Merchants' Lt. & Pwr. Co. has recently installed a 100-hp. boiler. J. F. Duncan is manager.

KENMARE, N. D.—The National Briquetting Co., of Kenmare, which owns the local electric-light plant, may possibly install an additional boiler and some synchronizing apparatus during this year. H. E. Soule is vice-president.

MINOT, N. D.—The Consumers' Pwr. Co. of Minot is enlarging its power station to provide space for new equipment, including two 240-hp. boilers and one 250-kw. generating unit. Contracts for machinery have been placed. J. F. McGuire is manager.

SENTINEL BUTTE, N. D.—J. C. Robertson, it is reported, has been granted a franchise to install an electric-light plant in Sentinel Butte.

CUSTER, S. D.—Within the next four months the Custer El. Lt., Ht. & Pwr. Co. expects to purchase one 75-hp. oil engine and one 12,000-gal. oil-storage tank. W. R. Jewell is superintendent.

CREIGHTON, NEB.—Within the next two months the Creighton Gas, El. Lt. & Pwr. Co. expects to erect a primary transmission line to the plant of the Creighton Milling Co. and install a 40-kw., three-phase generator, switchboard, etc., for a day service; also to purchase within the next 30 days a 40-kw. generator (belted). A. C. Hough is president and treasurer.

EDGAR, NEB.—Bids will be received by the city of Edgar until Sept. 3 for furnishing material and erecting a pole transmission line and an electrically driven pump. Plans and specifications may be obtained from V. L. Hollister of Lincoln, engineer, upon deposit of $5.

HASTINGS, NEB.—Within the next 30 days the city of Hastings expects to purchase one 750-kw. steam turbo-generator and condensing plant and steam-flow integrating meters; also one deep-well centrifugal pump (electrically driven), capacity 1000 gal. per minute. W. S. Watson is commissioner.

ARKANSAS CITY, KAN.—The Public Utilities Commission has authorized the Kansas Gas & El. Co. of Wichita to take

over the property and holdings of the Arkansas City Gas & El. Lt. Co.

HIAWATHA, KAN.—Arrangements have been made by the city of Robinson to secure electricity from the Hiawatha municipal electric plant to operate the proposed lighting system in that city, for which $10,000 in bonds was recently voted. The town of Everest is planning to install an electric-lighting system this fall and may secure energy from the plant in Hiawatha.

HUTCHINSON, KAN.—Plans are being prepared for enlarging the plant of the United Wtr., Gas & El. Co. in Hutchinson. Work will begin at once on the installation of a new boiler at the city water-works and electric plant. Arrangements are being made for the installation of an additional generating unit at any time. The output of the plant will be increased this summer to supply energy to operate several extensions in the power lines. The Arkansas Valley Interurban Ry. Co. has made arrangements to secure energy from the company to operate the extension from Hutchinson to Burrton. Electricity will be supplied to farms and smaller towns along the line. J. F. Springfield is manager.

LIBERAL, KAN.—The Kansas Lt., Ice & Pwr. Co. expects to purchase one 180-hp. to 200-hp. oil engine directly connected to engine. H. W. Magruder is president and manager.

LINCOLN, KAN.—Within the next two months the city of Lincoln expects to purchase some meters, wire and supplies for distribution and lighting systems. C. H. Berry is city clerk.

MANHATTAN, KAN.—The Manhattan Ice, Lt. & Pwr. Co., it is reported, is contemplating remodeling its power station and installing new equipment at a cost of about $30,000. E. A. Wright is manager.

MUSCOTAH, KAN.—The city of Muscotah has engaged C. A. Reid, engineer of Manhattan, to take charge of the installation of an electric-lighting system in Muscotah, for which $8,000 in bonds were recently voted.

Southern States

CHARLOTTE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 7, for construction complete, including mechanical equipment and approaches, of the United States post office and court house at Charlotte, N. C. Drawings and specifications may be obtained at the above office, or from custodian of site at Charlotte, N. C.

CLINTON, N. C.—The Sampson Pwr. Co. of Clinton expects to purchase within the next three months some line wire. C. W. Petty is secretary and treasurer.

DURHAM, N. C.—The Durham Trac. Co. expects to purchase within the next two months one condenser pump. The company will also purchase the usual amount of supplies for distribution and lighting systems, and electrical appliances and supplies.

EDENTOWN, N. C.—The Board of Public Works expects to purchase within the next six months one 150-hp. boiler and one 100-kva., three-phase generator, exciter and switchboard. J. C. Martin is superintendent.

LUMBERTON, N. C.—Improvements are contemplated to the municipal electric-light plant and water-works system, to cost about $25,000. Gilbert C. White of Charlotte, N. C., is consulting engineer.

INDIAN SPRINGS, GA.—Improvements are contemplated at the Indian Springs resort, including the installation of an electric-light plant, by the Misses Scoville, lessees of the Wigwam Hotel. Surveys and plans are now being made by Walter C. Sanders, mechanical engineer, of Macon.

SALERNO, FLA.—A company is being organized to construct and operate an electric-light plant, water-works, etc., in Salerno. B. W. Mulford and others are interested.

TITUSVILLE, FLA.—At an election to be held Sept. 20 the proposal to issue $35,000 in bonds to purchase the plant of the Titusville El. Lt. Co. will be submitted to the voters.

CHATTANOOGA, TENN.—The Public Lt. & Pwr. Co., 809 Georgia Avenue, Chattanooga, recently organized by J. W. and G. B. Adams and others, is a consolidation of the Tennessee Valley Lt. & Pwr. Co. of Chattanooga, Rhea County El. Lt. Co. of Dayton and several other light and power companies in east, lower and middle Tennessee.

HARTSELLE, ALA.—The Alabama Pwr. Co. of Birmingham has purchased the property of the Hartselle Lt. & Pwr. Co. The Alabama company will operate the local plant for the present, but will erect a transmission line through Hartselle within the next year, transmitting the energy from Muscle Shoals.

JACKSON, ALA.—The Jackson El. Co. is installing an electric-light plant and ice factory here. The equipment will consist of two Birmingham return tubular boilers, one 125-hp. Erie City engine, one 75-kva. Westinghouse three-phase, 60-cycle, 2300-volt generator, one three-phase machine and distributing switchboard panel and 20 General Electric transformers, aggregating 70 kva. The plant is also equipped with a 15-ton ice manufacturing machine. The street-lighting system consists of 50 6.6-amp., 100-cp. type C tungsten lamps. R. V. West is president.

RUSSELLVILLE, ALA.—The Sloss-Sheffield Steel & Iron Co. of Birmingham is contemplating extensive improvements at the Russellville iron-ore mines, involving an expenditure of $50,000. The work will include 6000 ft. pipe line, a 10-in., two-stage (electrically driven) centrifugal pump, central power station equipped with two Westinghouse turbo-generators with rating of 300 kw. each, several miles of copper transmission lines, electric motors to drive three washers, and others to be equipped for electrical operation later. Doubling the water-storage capacity (at central pumping station) by raising the dam, now 3 ft. high and 1000 ft. long, and providing new concrete spillway and relief valves in bottom, is also contemplated. It is reported that plans are under way for improvements to the North Birmingham furnace, but no appropriation has been made.

BRINKLEY, ARK.—Within the next four months the Brinkley Wtr. & Lt. Co. expects to erect transmission lines to connect up two nearby towns and will require material for 24 miles of pole transmission line. J. E. Thompson is president.

ADMANSON, OKLA.—Bids, it is reported, will be received until Sept. 20 by the city of Adamson for the construction of an electric-light plant.

HITCHCOCK, OKLA.—The installation of an electric-light plant in Hitchcock is under consideration. Messrs. Thomas & Ritchie, representing the Economy Ltg. & Mfg. Co. of Oklahoma City, are reported to be interested in the project.

SOPER, OKLA.—An election will soon be called to submit the proposal to issue bonds for the installation of a municipal electric-light plant to the voters.

TONKAWA, OKLA.—Within the next twelve months the city of Tonkawa expects to purchase a 20-amp., three-phase, 2300-volt, 60-cycle generator for the municipal electric-light plant; also to change over the present arc-lamp street-lighting system to incandescent lamps. V. K. Stanley is superintendent.

TULSA, OKLA.—The Sand Spring Pwr., Lt. & Wtr. Co. of Tulsa is installing a 1050-hp. vertical water-tube boiler plant and a 1250-kva. turbine. P. A. Smith is purchasing agent.

WOODWARD, OKLA.—The Woodward Cotton Co., which owns and operates the local electric-light plant, has recently completed a 50-barrel flour mill and an elevator to handle 50,000 bushels per day, the equipment to be operated by electricity. The company has also purchased three 25-kw. transformers. John Raynor is manager.

DEVINE, TEX.—The Devine Lt., Pwr. & Ice Co., recently organized with a capital stock of $35,000, is planning to install an electric-light plant in Devine. J. W. Fullerton is reported interested in the company.

GARLAND, TEX.—The North Texas Lt. & Pwr. Co. is reported to have been granted a franchise by the City Council to supply electricity for lamps and motors in Garland.

SPUR, TEX.—The Citizens' Gin & Pwr. Co. is contemplating installing an electric-light plant in Spur. C. D. Copeland is reported interested.

Pacific States

BELLINGHAM, WASH.—The City Council is considering replacing the arc lamps now in use with tungsten lamps.

STEPTOE, WASH.—The Steptoe Lt. & Pwr. Co. has applied to the County Commissioners for a 50-year franchise to erect and maintain transmission lines for the purpose of supplying electricity in Steptoe. E. N. Woodin of Colfax is interested in the company.

BAKER, ORE.—The Eastern Oregon Lt. & Pwr. Co. of Baker will purchase from time to time such quantities of electric appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc., as are needed to meet demands. F. A. Harmon is manager.

CASCADE LOCKS, ORE.—Within the next six months the Columbia River Lt. & Pwr. Co. of Cascade Locks expects to build a new power house and to erect 7 miles of transmission line; also to purchase one 150-kw. to 200-kw. generator, one impulse waterwheel, exciter, switches, protection device and governor, transformers, lightning arresters, insulators, meter, etc. G. A. Young is president.

EUGENE, ORE.—The Oregon Pwr. Co. is contemplating the purchase of a few electric stoves and a small quantity of wire. Attila Norman is general manager.

HEPPNER, ORE.—The Heppner Lt. & Wtr. Co. expects to erect within the next three months 20 miles of transmission lines to transmit energy from its plant in Heppner to the towns of Lexington and Ione, and also to purchase material for same. A. B. Gates is treasurer.

INDEPENDENCE, ORE.—The Oregon Pwr. Co. of Independence expects to purchase within the next eight months a limited number of poles, transformers, electric ranges and small electrical appliances. E. M. Blenis is superintendent.

JOSEPH, ORE.—The Joseph Lt. & Pwr. Co. expects to erect within the next two months 2 miles of transmission lines. F. D. McCully is president.

COACHELLA, CAL.—At an election to be held Sept. 4 the proposal to establish a lighting district will be submitted to the voters.

LOS ANGELES, CAL.—The finance committee of the City Council has included in the tentative budget which it is preparing an item calling for bonds to be issued to the amount of $500,000 for a police and fire-alarm system.

REDWOOD CITY, CAL.—The installation of an ornamental lighting system on the principal streets of the city is under consideration by the city trustees.

SAUSALITO, CAL.—Bids will be received by the Board of Trustees until Aug. 30 for installation of an electrolier street-lighting system, consisting of 65 standards, together with lamps, globes, etc. The cost is estimated at about $4,000. Plans and specifications may be obtained from the town engineer upon deposit of $10.

RUPERT, IDAHO.—The City Council is reported to be considering the proposal to take over the local electric-light plant and make improvements to same.

GLASGOW, MONT.—At a special election to be held Oct. 4 the proposal to issue $18,000 in bonds for extensions to the municipal electric-lighting system will be submitted to the voters.

GREAT FALLS, MONT.—The City Council has adopted a resolution creating lighting districts on Third and Fourth Avenues North, where a new lighting system will be installed.

HYSHAM, MONT.—The Town Council has engaged the Billings Engineering & Contracting Co. of Billings as consulting engineers in connection with the construction of the proposed municipal electric-light plant and water-works system.

ROUNDUP, MONT.—The Roundup Coal Mining Co., which owns and operates the local electric light and power plant, will make improvements to the plant at once, including the installation of a 200-kw., 2300-volt generator, two boilers, etc. The city contemplates the installation of a new street-lighting system, electricity to be supplied by the Roundup Coal Mining Co.

LANDER, WYO.—Plans are being prepared, it is reported, by P. B. Dykeman and other Chicago capitalists for the construction of a power plant in Popo Agie Canyon.

LOVELOCKS, NEV.—The Lovelocks & Woolsey Lt. & Pwr. Co. of Lovelocks expects to purchase within the next six months one 250-hp. waterwheel directly connected to alternator, one governor for same, one 250-hp. Diesel engine directly connected to alternator, one set oil filters, three 100-kw. transformers, and all kinds of electrical appliances. C. L. Young is superintendent.

CARLSBAD, N. M.—Within the next three months the Public Utilities Co. of Carlsbad expects to erect a third transmission line to power house (6 miles from town) of No. 1 bare copper wire, changing transmission system from single-phase to three-phase, also to purchase within the next three months one 150-kw., three-phase, 2300-volt generator and exciter for same, governor for a 40-in. Samson turbine, oil switches, etc., for switchboard, 6 miles of No. 1 bare copper wire, 220 pole-top pin and insulators. Eugene A. Roberts is manager.

PORTALES, N. M.—The city of Portales expects to purchase within the next twelve

months material for electrical and waterworks distribution system, and also various electrical supplies and appliances for the municipal electric-light and water-works systems. W. H. Braley is city clerk of Portales.

SILVER CITY, N. M.—Within the next 12 months the Silver City Pwr. Co. expects to purchase wiring material, supplies, etc. M. B. Buchanan is manager.

Canada

ATHENS, ONT.—The City Council has authorized plans prepared for the installation of a new electric light and power plant, to cost about $25,000.

HAMILTON, ONT.—Estimates have been completed by the Hamilton Hydro Commission for the establishment of a civic telephone system, the present cement poles of the municipal power plant to be used. A second estimate is being made with a view to the installation of an automatic system.

LEWISBURG, ONT.—The Brooksville-Lewisburg Lt. Co. of Lewisburg has recently completed the extension of its transmission lines to the towns of Verona and Gordon and will begin work on the erection of a 2300-volt line to the towns of Ithaca and Sonora as soon as material arrives. The company will also supply electricity to farmers residing along the line.

MADOC, ONT.—The Madoc Mining Co., it is reported, will soon begin work on the construction of a power house at Goudreau, to cost about $75,000.

PALMERSTON, ONT.—The City Council has engaged H. Hyndman to prepare plans for the construction of a new hydro-electric power plant and distribution system, to cost about $75,000.

Miscellaneous

HILO, HAWAII—Within the next 18 months the Hilo El. Lt. Co. expects to construct a hydroelectric power plant (No. 2) with an output of about 800 kva., alternating current, 60 cycles, 2200 volts, with complete equipment, consisting of waterwheels, generators, exciters, etc. J. C. Mocine is manager.

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Sept. 13, for furnishing motor-driven capstans, switchboards, cables and miscellaneous equipment for Dry Dock No. 1, Balboa Terminal. Blanks and general information relating to this circular (No. 962) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal. Major F. C. Boggs is purchasing officer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 10, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,149,172. ELECTRIC FLATIRON; H. P. Ball, Pittsfield, Mass. App. filed Aug. 6, 1909. Resistance unit cast in the body of the iron.

1,149,173. RESISTANCE ELEMENT; H. P. Ball, Pittsfield, Mass. App. filed Aug. 6, 1909. Resistance conductor laid between insulation in flattened tube.

1,149,188. INCANDESCENT LAMP; F. Dickenschied, Berlin, Germany. App. filed July 26, 1912. Filament flattened at the region of contact with the holder.

1,149,199. TAMPERING-PREVENTING DEVICE FOR FIRE-ALARM BOXES; J. Karoly, Chicago, Ill. App. filed April 5, 1915. Has a hand-grasping device.

1,149,203. ELECTRIC FURNACE; J. G. Marshall, Niagara Falls, N. Y. App. filed Oct. 10, 1914. Self-formed spout of the chilled product of the furnace.

1,149,207. AUTOMATIC SWITCH-CONTROLLING MEANS; W. S. Menden, Brooklyn, N. Y. App. filed Dec. 2, 1913. For vehicle lights.

1,149,210. ELECTROLYTIC CELL; H. R. Nelson, Elizabeth, N. J. App. filed Aug. 17, 1914. For electrolysis of sodium chloride, etc.

1,149,211. METHOD OF ELECTROLYSIS; H. R. Nelson, Elizabeth, N. J. App. filed Aug. 17, 1914. Steam or like medium is supplied to the cathion.

1,149,229. TELEPHONE SYSTEM; R. I. Utter, Chicago, Ill. App. filed Aug. 15, 1912. Improved control circuits.

1,149,238. ELECTRIC-FURNACE REGULATOR; R. H. White, Niagara Falls, N. Y. App. filed Sept. 8, 1914. Electrode moved short of point required.

1,149,245. VEHICLE SIGNAL APPARATUS; B. L. Bobroff, Milwaukee, Wis. App. filed Dec. 5, 1914. Pivoted signal arms at opposite side of wind shield.

1,149,275. ELECTROMAGNET; J. F. McElroy (deceased), Albany, N. Y. App. filed March 7, 1911. For pneumatic valves.

1,149,282. INSULATOR-SUPPORTING FIXTURE; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed May 4, 1914. Pipe lengths secured together by castings.

1,149,295. RECORD SHEET AND METHOD OF MAKING THE SAME; E. O. Schweitzer, Chicago, Ill. App. filed Aug. 12, 1911. For synchronizing alternating-current generators, etc.

1,149,312. SWITCH MOVEMENT; B. C. Webster, Bridgeport, Conn. App. filed Sept. 8, 1914. For key-lamp sockets.

1,149,315. ELECTRIC SWITCH; C. J. Zigler and W. P. Holden, Chicago, Ill. App. filed Aug. 27, 1913. Service switch substituted for knife switches commonly used.

1,149,325. ELECTRIC SWITCH; T. E. Barnum, Milwaukee, Wis. App. filed April 8, 1912. Pressure-operated snap action.

1,149,362. WALL SWITCH; D. D. Gordon, Chicago, Ill. App. filed Feb. 12, 1914. Single-button push switch.

1,149,395. VALIDATING STAMPING SYSTEM; W. H. Muzzy, Dayton, Ohio. App. filed Dec. 27, 1904. Validating stamps controlled by "credit man" at central office.

1,149,409. QUICK-BREAK ELECTRIC SWITCH; E. Schwartz, Chicago, Ill. App. filed March 23, 1912. Switch-plug construction for electric iron.

1,149,418. SIGNALING SYSTEM; H. B. Stone, Providence, R. I. App. filed Aug. 9, 1913. Employs alternating or pulsating current.

1,149,428. TELEGRAPHY; P. B. Delany, South Orange, N. J. App. filed Jan. 9, 1911. Successive impulses directed alternately into two lines.

1,149,437. TERMINAL FOR ELECTRIC WIRES; V. C. H. Gibson, Camden Town, Eng. App. filed May 15, 1913. Perforated flattened bar with surrounding sleeve.

1,149,496. RELAY; H. W. Cheney, Milwaukee, Wis. App. filed April 17, 1911. Time element; high voltage.

1,149,547. APPARATUS FOR ENABLING THE BLIND TO READ; Henry Tideman, Menominee, Mich. App. filed Sept. 16, 1908. An electric stylus engages with code perforations in a record.

1,149,558. ELECTRICAL ACCUMULATOR; C. de Sedneff, Paris, France. App. filed Dec. 20, 1913. Ribbed grid.

1,149,583. SIGNAL DEVICE AND PROJECTOR THEREFOR; M. R. Hutchison, Summit, N. J. App. filed April 6, 1911. Electric siren construction.

1,149,586. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed May 31, 1911. Push-button construction insertable into different forms of casing.

1,149,705—Searchlight for Firearms

1,149,592. MULTIDUCT; T. E. Murray and A. V. A. McHarg, New York, N. Y. App. filed April 30, 1913. Corrugated plates secured together to provide conducts.

1,149,599. JUNCTION OR TERMINAL BLOCK; H. Small, Wyncote, Pa. App. filed Oct. 17, 1913. Plurality of connections clamped together by a single bolt.

1,149,600. SYSTEM OF MOTOR CONTROL; J. C. Smith, Louisville, Ky. App. filed May 8, 1913. "Full-magnet" control for elevators.

1,149,601. REVERSIBLE ELECTRIC MOTOR; F. M. Spencer and G. W. Warnholz, San Francisco, Cal., and W. J. Wigmore, Oakland, Cal. App. filed Jan. 28, 1913. For vehicles.

1,149,603. PROTECTIVE DEVICE FOR BUSBAR CIRCUITS; P. Torchio and H. R. Woodrow, New York, N. Y. App. filed Oct. 28, 1914. Reactance coils connected to busbar.

1,149,610. ACOUSTIC APPARATUS FOR DETECTING SOUND VIBRATIONS IN NON-GASEOUS MEDIA; D. W. Allis, Revere, Mass. App. filed March 11, 1908. For detection of leaks, broken bearings, etc.

1,149,614. TOLL TELEPHONE SYSTEM; E. P. Baird, Evanston, Ill. App. filed July 12, 1902. Control by central operator is avoided.

1,149,651. TROLLEY MECHANISM FOR RAILWAY CARS; C. Kasper, Chicago, Ill. App. filed July 11, 1914. Trolley finder with advantageous features.

1,149,665. ELECTRIC BATTERY; F. N. Mason, Pittsburgh, Pa. App. filed Oct. 25, 1913. Improved dry cell.

1,149,666. REFILLABLE ELECTRIC BATTERY; F. N. Mason, Pittsburgh, Pa. App. filed July 29, 1914. Has compressed dry cakes of active and depolarizing material.

1,149,701 DUCTILE FILAMENT; O. M. Thowless, Newark, N. J. App. filed March 20, 1914. Wrought filament composed of a flashing of tungsten.

1,149,705. SEARCHLIGHT FOR FIREARMS; E. S. Ward, Portland, Ore. App. filed March 6, 1913. Light detachably secured to revolver barrel.

1,149,721. TROLLEY FROG; W. H. Brown, Jerome, Pa. App. filed March 26, 1915. Has removable central wearing plate.

1,149,735. ELECTRIC SWITCH; J. L. Creveling, New York, N. Y. App. filed Dec. 29, 1911. Particularly for battery charging.

1,149,755. SWITCH; G. W. Hart, West Hartford, Conn. App. filed May 1, 1914. Particularly for automobiles.

1,149,789. MEANS FOR OPERATING SWITCH MECHANISMS; R. A. Schoenberg, Branchport, N. J. App. filed Feb. 9, 1914. Operates by longitudinal movement of a part of the lamp socket.

1,149,798. IGNITION APPARATUS AND SYSTEM AND METHOD OF SPARK CONTROL; R. Varley, Englewood, N. J. App. filed Dec. 23, 1913. Improved means for adjusting timer and distributer.

1,149,822. SOUND-AMPLIFYING DEVICE; P. J. Hackett, Seattle, Wash. App. filed July 6, 1914. Improved construction with adjusting means.

1,149,829. PORTABLE GENERATOR FOR PRODUCING RADIO-ACTIVITY IN VARYING SUBSTANCES; C. R. Heberling and A. H. Low, Denver, Col. App. filed March 23, 1914. Portable container for insoluble radium containing agent.

1,149,843. IGNITION BREAKING DEVICE; L. J. Le Pontois, Cleveland, Ohio. App. filed June 23, 1910. Rapid interruption of the circuit at the breaker irrespective of speed.

1,149,874. SYSTEM OF ELECTRICAL SIGNALING; C. R. Underhill, New Haven, Conn. App. filed Aug. 4, 1904. Wireless; secures differentiation between the transmitted and the translated signals.

1,149,913. FLASHLIGHT; H. H. and H. T. Hipwell, Pittsburgh, Pa. App. filed April 14, 1915. Metallic casing forms one side or circuit; special switch construction.

1,149,933. ILLUMINATED MATCH STAND AND AUTOMATIC ELECTRIC WAITER SIGNAL; A. Martzolf, New York, N. Y. App. filed Sept. 1, 1914. Lamp is projected above stand to attract waiter.

1,149,973. ANNUNCIATOR FIXTURE FOR RESIDENCES; E. E. Berthold, Chicago, Ill. App. filed July 8, 1912. Apartment-house bell, door-opener and speaking-tube fixture.

1,149,979. UNIVERSAL SOUND-TRANSMITTING MEANS; P. J. Hackett, Seattle, Wash. App. filed Oct. 4, 1913. Avoids waste of current.

1,149,980. INTERRUPTER; C. Hartmann, Lancaster, N. Y. App. filed June 11, 1913. Cam-roller construction.

1,149,998. DYNAMO-ELECTRIC GENERATOR; G. and L. Inrig, London, Eng. App. filed June 4, 1912. Car-axle type.

1,150,001. ELECTRIC SWITCH FOR ELECTRIC LAMPS AND THE LIKE; A. H. Miller, Detroit, Mich. App. filed May 10, 1906. Thermostatic flasher.